

## REFERENCES:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3<sup>rd</sup> Edition, 2010.

## CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	2	-	-	2	-	-	-	3	-	-	-	-	-
4	-	2	2	2	-	-	-	-	-	-	-	-	-	-	-
5	-	2	2	2	-	-	-	-	-	2	-	-	-	-	-
Avg.	1	3	2	1	-	-	-	-	-	1	-	-	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

CS3351

DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

L T P C

3 0 2 4

## COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

### UNIT I COMBINATIONAL LOGIC

9

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

### UNIT II SYNCHRONOUS SEQUENTIAL LOGIC

9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

### UNIT III COMPUTER FUNDAMENTALS

9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

### UNIT IV PROCESSOR

9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

**UNIT V                  MEMORY AND I/O                  9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

**45 PERIODS**

**PRACTICAL EXERCISES:**

**30 PERIODS**

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture

**COURSE OUTCOMES:**

**At the end of this course, the students will be able to:**

**CO1 :** Design various combinational digital circuits using logic gates

**CO2 :** Design sequential circuits and analyze the design procedures

**CO3 :** State the fundamentals of computer systems and analyze the execution of an instruction

**CO4 :** Analyze different types of control design and identify hazards

**CO5 :** Identify the characteristics of various memory systems and I/O communication

**TOTAL: 75 PERIODS**

**TEXT BOOKS:**

1. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

**REFERENCES:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

**CO's-PO's & PSO's MAPPING**

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	1	1	1	1	2	3	2	3	3
2	3	3	3	3	2	1	1	1	1	1	2	3	1	2	2
3	3	3	3	3	2	2	1	1	1	1	2	3	2	3	1
4	3	3	3	3	1	1	1	1	1	1	1	2	1	3	1
5	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1
Avg.	3	3	3	3	1.8	1.6	1	1	1	1	1.6	2.6	1.4	2.6	1.6

1 - low, 2 - medium, 3 - high, “--“ no correlation

**CS3352**

**FOUNDATIONS OF DATA SCIENCE**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

**UNIT I INTRODUCTION**

**9**

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

**UNIT II DESCRIBING DATA**

**9**

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

**UNIT III DESCRIBING RELATIONSHIPS**

**9**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r<sup>2</sup> –multiple regression equations –regression towards the mean

**UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING**

**9**

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

**UNIT V DATA VISUALIZATION**

**9**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

**COURSE OUTCOMES:**

**At the end of this course, the students will be able to:**

**CO1:** Define the data science process

**CO2:** Understand different types of data description for data science process

**CO3:** Gain knowledge on relationships between data

**CO4:** Use the Python Libraries for Data Wrangling

**CO5:** Apply visualization Libraries in Python to interpret and explore data

**TOTAL:45 PERIODS**

**TEXT BOOKS**

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)

3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)

## REFERENCES:

- Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

## CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
2	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
3	2	2	1	2	2	1	1	-	1	2	1	3	2	2	3
4	3	2	2	1	2	-	-	-	1	1	2	2	3	3	2
5	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
Avg.	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1 - low, 2 - medium, 3 - high, “--“ no correlation

CS3301

DATA STRUCTURES

L T P C  
3 0 0 3

## COURSE OBJECTIVES:

- To understand the concepts of ADTs.
- To Learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.
- To apply Tree and Graph structures.

### UNIT I        LISTS

9

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

### UNIT II        STACKS AND QUEUES

9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

### UNIT III        TREES

9

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

### UNIT IV        MULTIWAY SEARCH TREES AND GRAPHS

9

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

UNIT V            SEARCHING, SORTING AND HASHING TECHNIQUES

9

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

## **COURSE OUTCOMES:**

At the end of this course, the students will be able to:

## CO1: Define linear and non-linear data structures.

**CO2:** Implement linear and non-linear data structure operations.

**CO3:** Use appropriate linear/non-linear data structure operations for solving a given problem.

**CO4:** Apply appropriate graph algorithms for graph applications.

**CO5:** Analyze the various searching and sorting algorithms.

TOTAL 45 PERIODS

## **TEXT BOOKS**

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
  2. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

## REFERENCES

1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
  2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
  3. Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
  4. Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
Avg.	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3391

## OBJECT ORIENTED PROGRAMMING

L T P C  
3 0 0 3

## COURSE OBJECTIVES

- To understand Object Oriented Programming concepts and basics of Java programming language
  - To know the principles of packages, inheritance and interfaces
  - To develop a java application with threads and generics classes
  - To define exceptions and use I/O streams
  - To design and build Graphical User Interface Application using JAVAFX

<b>UNIT I</b>	<b>INTRODUCTION TO OOP AND JAVA</b>	<b>9</b>
Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments		
<b>UNIT II</b>	<b>INHERITANCE, PACKAGES AND INTERFACES</b>	<b>9</b>
Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.		
<b>UNIT III</b>	<b>EXCEPTION HANDLING AND MULTITHREADING</b>	<b>9</b>
Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.		
<b>UNIT IV</b>	<b>I/O, GENERICS, STRING HANDLING</b>	<b>9</b>
I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.		

<b>UNIT V</b>	<b>JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS</b>	<b>9</b>
JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.		

### **COURSE OUTCOMES:**

On completion of this course, the students will be able to

**CO1:**Apply the concepts of classes and objects to solve simple problems

**CO2:**Develop programs using inheritance, packages and interfaces

**CO3:**Make use of exception handling mechanisms and multithreaded model to solve real world problems

**CO4:**Build Java applications with I/O packages, string classes, Collections and generics concepts

**CO5:**Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

**TOTAL:45 PERIODS**

### **TEXT BOOKS:**

1. Herbert Schildt, "Java: The Complete Reference", 11<sup>th</sup> Edition, McGraw Hill Education, New Delhi, 2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1<sup>st</sup> Edition, McGraw Hill Education, New Delhi, 2015

### **REFERENCE:**

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11<sup>th</sup> Edition, Prentice Hall, 2018.

### CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	3	1	3	-	-	-	3	2	2	2	3	1	2
2	2	1	3	2	1	-	-	-	2	1	1	3	3	3	2
3	3	3	1	2	2	-	-	-	3	2	1	2	3	1	3
4	3	1	2	2	2	-	-	-	1	2	1	3	3	1	1
5	1	1	2	3	2	-	-	-	3	2	1	2	3	3	3
Avg.	2	1	2	2	2	-	-	-	2	2	1	2	3	2	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3311

DATA STRUCTURES LABORATORY

L T P C  
0 0 3 1.5

### COURSE OBJECTIVES:

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstra's algorithm.
- To implement Prim's algorithm
- To implement Sorting, Searching and Hashing algorithms.

### LIST OF EXERCISES:

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra's Algorithm
10. Implementation of Prim's Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort
14. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

**TOTAL:45 PERIODS**

### COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Implement Linear data structure algorithms.
- CO2:** Implement applications using Stacks and Linked lists
- CO3:** Implement Binary Search tree and AVL tree operations.
- CO4:** Implement graph algorithms.
- CO5:** Analyze the various searching and sorting algorithms.

### CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	2	1	-	-	-	-	2	1	2	2	2	2	3
2	3	3	1	1	-	-	-	-	1	1	1	3	1	2	2
3	2	1	3	1	-	-	-	-	1	1	2	3	3	3	3
4	3	1	3	3	-	-	-	-	1	2	3	3	2	1	2
5	3	2	1	1	2	-	-	-	3	3	3	1	3	1	3
Avg.	2	2	2	1	2	-	-	-	2	2	2	2	2	2	3

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3381

OBJECT ORIENTED PROGRAMMING LABORATORY

L T P C  
0 0 3 1.5

### COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

### LIST OF EXPERIMENTS:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On completion of this course, the students will be able to

**CO1 :** Design and develop java programs using object oriented programming concepts

**CO2 :** Develop simple applications using object oriented concepts such as package, exceptions

**CO3:** Implement multithreading, and generics concepts

**CO4 :** Create GUIs and event driven programming applications for real world problems

**CO5:** Implement and deploy web applications using Java

#### CO's-PO's & PSO's MAPPING

CO's	PO's	PSO's													
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	1	-	-	-	-	1	2	2	2	1	2	3
2	2	1	3	1	-	-	-	-	2	3	3	2	1	3	1
3	2	2	1	2	1	-	-	-	1	2	1	3	2	3	2
4	2	2	1	3	-	-	-	-	3	1	1	1	2	1	2
5	1	3	3	1	3	-	-	-	1	1	1	1	2	1	2
Avg.		2	2	2	2	2	-	-	-	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, “-“- no correlation

**CS3361**

**DATA SCIENCE LABORATORY**

**L T P C**  
**0 0 4 2**

#### COURSE OBJECTIVES:

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.
- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python.

#### LIST OF EXPERIMENTS:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
  - a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
  - b. Bivariate analysis: Linear and logistic regression modeling
  - c. Multiple Regression analysis
  - d. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
  - a. Normal curves
  - b. Density and contour plots
  - c. Correlation and scatter plots
  - d. Histograms
  - e. Three dimensional plotting
7. Visualizing Geographic Data with Basemap

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**At the end of this course, the students will be able to:**

- CO1:** Make use of the python libraries for data science
- CO2:** Make use of the basic Statistical and Probability measures for data science.
- CO3:** Perform descriptive analytics on the benchmark data sets.
- CO4:** Perform correlation and regression analytics on standard data sets
- CO5:** Present and interpret data using visualization packages in Python.

**CO's-PO's & PSO's MAPPING**

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	-	1	3	3	3	1	3	2
2	3	2	2	3	1	-	-	-	3	1	3	2	1	3	3
3	3	2	1	3	1	-	-	-	2	1	1	1	3	2	3
4	2	3	1	3	-	-	-	-	2	3	2	3	3	3	1
5	1	2	3	1	1	-	-	-	2	1	3	1	1	3	3
Avg.	2	2	2	2	1	-	-	-	2	2	2	2	2	3	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

**GE3361****PROFESSIONAL DEVELOPMENT**

**L T P C**  
**0 0 2 1**

**COURSE OBJECTIVES:**

To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

**MS WORD:****10 Hours**

Create and format a document

Working with tables

Working with Bullets and Lists

Working with styles, shapes, smart art, charts

Inserting objects, charts and importing objects from other office tools

Creating and Using document templates

Inserting equations, symbols and special characters

Working with Table of contents and References, citations

Insert and review comments

Create bookmarks, hyperlinks, endnotes footnote

Viewing document in different modes

Working with document protection and security

Inspect document for accessibility

**MS EXCEL:** **10 Hours**

Create worksheets, insert and format data

Work with different types of data: text, currency, date, numeric etc.

Split, validate, consolidate, Convert data

Sort and filter data

Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)

Work with Lookup and reference formulae

Create and Work with different types of charts

Use pivot tables to summarize and analyse data

Perform data analysis using own formulae and functions

Combine data from multiple worksheets using own formulae and built-in functions to generate results

Export data and sheets to other file formats

Working with macros

Protecting data and Securing the workbook

**MS POWERPOINT:** **10 Hours**

Select slide templates, layout and themes

Formatting slide content and using bullets and numbering

Insert and format images, smart art, tables, charts

Using Slide master, notes and handout master

Working with animation and transitions

Organize and Group slides

Import or create and use media objects: audio, video, animation

Perform slideshow recording and Record narration and create presentable videos

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

On successful completion the students will be able to

**CO1:** Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements

**CO2:** Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

**CO3:** Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

<b>CS3452</b>	<b>THEORY OF COMPUTATION</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**COURSE OBJECTIVES:**

- To understand foundations of computation including automata theory
- To construct models of regular expressions and languages.
- To design context free grammar and push down automata
- To understand Turing machines and their capability
- To understand Undecidability and NP class problems

**UNIT I AUTOMATA AND REGULAR EXPRESSIONS 9**

Need for automata theory - Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Equivalence of NFA and DFA- Equivalence of NFAs with and without  $\epsilon$ -moves- Conversion of NFA into DFA – Minimization of DFAs.

**UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9**

Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions – Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages.

**UNIT III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA 9**

Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata.

**UNIT IV NORMAL FORMS AND TURING MACHINES 9**

Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) – Pumping lemma for CFL – Closure properties of Context Free Languages –Turing Machine : Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).

**UNIT V UNDECIDABILITY 9**

Unsolvable Problems and Computable Functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine -Tractable and Intractable problems

- P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem- 3-CNF SAT problems.

### COURSE OUTCOMES:

At the end of this course, the students will be able to:

- CO1:** Construct automata theory using Finite Automata
- CO2:** Write regular expressions for any pattern
- CO3:** Design context free grammar and Pushdown Automata
- CO4:** Design Turing machine for computational functions
- CO5:** Differentiate between decidable and undecidable problems

**TOTAL:45 PERIODS**

### TEXT BOOKS:

1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008.
2. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2011.

### REFERENCES:

1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, 2015.
2. Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett, 2016.
3. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3<sup>rd</sup> Edition, Prentice Hall of India, 2006.

### CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	3	2	3	-	-	-	-	1	1	2	3	1	3	2
2	2	2	3	2	1	-	-	-	3	3	2	3	3	1	2
3	2	2	3	2	1	-	-	-	1	3	1	2	1	2	2
4	2	2	2	1	-	-	-	-	1	3	3	2	1	3	2
5	2	2	2	1	1	-	-	-	1	1	3	2	3	1	3
Avg.	2	2	2	2	1	-	-	-	1	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3491

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L T P C

3 0 2 4

### COURSE OBJECTIVES:

The main objectives of this course are to:

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

<b>UNIT I</b>	<b>PROBLEM SOLVING</b>	<b>9</b>
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)		
<b>UNIT II</b>	<b>PROBABILISTIC REASONING</b>	<b>9</b>
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.		
<b>UNIT III</b>	<b>SUPERVISED LEARNING</b>	<b>9</b>
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests		
<b>UNIT IV</b>	<b>ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING</b>	<b>9</b>
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization		
<b>UNIT V</b>	<b>NEURAL NETWORKS</b>	<b>9</b>
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.		
<b>PRACTICAL EXERCISES:</b>		<b>45 PERIODS</b>
		<b>30 PERIODS</b>
<ol style="list-style-type: none"> <li>1. Implementation of Uninformed search algorithms (BFS, DFS)</li> <li>2. Implementation of Informed search algorithms (<math>A^*</math>, memory-bounded <math>A^*</math>)</li> <li>3. Implement naïve Bayes models</li> <li>4. Implement Bayesian Networks</li> <li>5. Build Regression models</li> <li>6. Build decision trees and random forests</li> <li>7. Build SVM models</li> <li>8. Implement ensembling techniques</li> <li>9. Implement clustering algorithms</li> <li>10. Implement EM for Bayesian networks</li> <li>11. Build simple NN models</li> <li>12. Build deep learning NN models</li> </ol>		

#### **COURSE OUTCOMES:**

At the end of this course, the students will be able to:

- CO1:** Use appropriate search algorithms for problem solving
- CO2:** Apply reasoning under uncertainty
- CO3:** Build supervised learning models
- CO4:** Build ensembling and unsupervised models
- CO5:** Build deep learning neural network models

**TOTAL:75 PERIODS**

**TEXT BOOKS:**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

**REFERENCES:**

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education, 2007
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (<http://nptel.ac.in/>)
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
6. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
7. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014
8. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
9. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016

**CO's-PO's & PSO's MAPPING**

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	3	-	-	-	-	1	3	3	3	1	2	2
2	1	1	1	3	1	-	-	-	1	2	1	3	2	3	2
3	2	1	2	1	1	-	-	-	2	1	1	3	1	1	1
4	3	1	3	1	-	-	-	-	2	1	2	1	2	2	2
5	3	1	1	2	2	-	-	-	3	1	2	3	2	1	2
AVg.	2	1	2	2	1	-	-	-	2	2	2	3	2	2	2

1 - low, 2 - medium, 3 - high, “--“ no correlation

CS3492

DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

**COURSE OBJECTIVES:**

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

<b>UNIT I</b>	<b>RELATIONAL DATABASES</b>	<b>10</b>
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Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

<b>UNIT II</b>	<b>DATABASE DESIGN</b>	<b>8</b>
Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form		
<b>UNIT III</b>	<b>TRANSACTIONS</b>	<b>9</b>
Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control – Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm		
<b>UNIT IV</b>	<b>IMPLEMENTATION TECHNIQUES</b>	<b>9</b>
RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.		
<b>UNIT V</b>	<b>ADVANCED TOPICS</b>	<b>9</b>
Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges		

#### **COURSE OUTCOMES:**

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

- CO1:** Construct SQL Queries using relational algebra
- CO2:** Design database using ER model and normalize the database
- CO3:** Construct queries to handle transaction processing and maintain consistency of the database
- CO4:** Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
- CO5:** Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

**TOTAL:45 PERIODS**

#### **TEXT BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017

#### **REFERENCES:**

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

## CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3	2	1	-	-	-	2	1	1	1	2	1	3
2	3	1	1	1	1	-	-	-	2	3	3	3	3	1	2
3	3	2	3	2	1	-	-	-	2	1	1	2	2	3	3
4	1	2	3	2	-	-	-	-	3	2	3	3	1	2	3
5	1	1	3	3	2	-	-	-	1	3	3	1	2	2	2
AVg.	2	2	3	2	1	-	-	-	2	2	2	2	2	2	3

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3401

ALGORITHMS

L T P C  
3 0 2 4

### COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques on searching and sorting algorithms
- To critically analyze the efficiency of graph algorithms
- To understand different algorithm design techniques
- To solve programming problems using state space tree
- To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

### UNIT I INTRODUCTION

9

**Algorithm analysis:** Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – **searching:** linear search, binary search and Interpolation Search, **Pattern search:** The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. **Sorting:** Insertion sort – heap sort

### UNIT II GRAPH ALGORITHMS

9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching

### UNIT III ALGORITHM DESIGN TECHNIQUES

9

**Divide and Conquer methodology:** Finding maximum and minimum - Merge sort - Quick sort **Dynamic programming:** Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. **Greedy Technique:** Elements of the greedy strategy - Activity-selection problem -- Optimal Merge pattern — Huffman Trees.

### UNIT IV STATE SPACE SEARCH ALGORITHMS

9

**Backtracking:** n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem **Branch and Bound:** Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

**UNIT V****NP-COMPLETE AND APPROXIMATION ALGORITHM**

9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-CNF problem. **Approximation Algorithms:** TSP - **Randomized Algorithms:** concept and application - primality testing - randomized quick sort - Finding  $k^{\text{th}}$  smallest number

**45 PERIODS****PRACTICAL EXERCISES:****30 PERIODS****Searching and Sorting Algorithms**

1. Implement Linear Search. Determine the time required to search for an element. Repeat the experiment for different values of  $n$ , the number of elements in the list to be searched and plot a graph of the time taken versus  $n$ .
2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of  $n$ , the number of elements in the list to be searched and plot a graph of the time taken versus  $n$ .
3. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that  $n > m$ .
4. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of  $n$ , the number of elements in the list to be sorted and plot a graph of the time taken versus  $n$ .

**Graph Algorithms**

1. Develop a program to implement graph traversal using Breadth First Search
2. Develop a program to implement graph traversal using Depth First Search
3. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
4. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
5. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
6. Compute the transitive closure of a given directed graph using Warshall's algorithm.

**Algorithm Design Techniques**

1. Develop a program to find out the maximum and minimum numbers in a given list of  $n$  numbers using the divide and conquer technique.
2. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of  $n$ , the number of elements in the list to be sorted and plot a graph of the time taken versus  $n$ .

**State Space Search Algorithms**

1. Implement N Queens problem using Backtracking.

**Approximation Algorithms Randomized Algorithms**

1. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
2. Implement randomized algorithms for finding the  $k^{\text{th}}$  smallest number.  
The programs can be implemented in C/C++/JAVA/ Python.

**TOTAL:75 PERIODS****COURSE OUTCOMES:**

At the end of this course, the students will be able to:

**CO1:** Analyze the efficiency of algorithms using various frameworks

**CO2:** Apply graph algorithms to solve problems and analyze their efficiency.

**CO3:** Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems

**CO4:** Use the state space tree method for solving problems.

**CO5:** Solve problems using approximation algorithms and randomized algorithms

#### TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2<sup>nd</sup> Edition, 2019.

#### REFERENCES:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.
3. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

#### CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-		1	-	-	-	-	1	-	1	-
2	2	3	-	-	-	-	1	-	-	-	-	1	-	1	-
3	1	2	3	1	-	-	2	-	-	-	-	-	-	1	1
4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
AVg.	2.67	1.8	3	1	-	-	1.33	-	-	-	-	1	-	1	1

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

CS3451

INTRODUCTION TO OPERATING SYSTEMS

L T P C  
3 0 0 3

#### COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand processes and threads
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

#### UNIT I INTRODUCTION

7

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

<b>UNIT II</b>	<b>PROCESS MANAGEMENT</b>	<b>11</b>
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.		
<b>UNIT III</b>	<b>MEMORY MANAGEMENT</b>	<b>10</b>
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.		
<b>UNIT IV</b>	<b>STORAGE MANAGEMENT</b>	<b>10</b>
Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.		
<b>UNIT V</b>	<b>VIRTUAL MACHINES AND MOBILE OS</b>	<b>7</b>
Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.		

**TOTAL:45 PERIODS**

#### **COURSE OUTCOMES:**

**At the end of this course, the students will be able to:**

- CO1 :** Analyze various scheduling algorithms and process synchronization.
- CO2 :** Explain deadlock prevention and avoidance algorithms.
- CO3 :** Compare and contrast various memory management schemes.
- CO4 :** Explain the functionality of file systems, I/O systems, and Virtualization
- CO5 :** Compare iOS and Android Operating Systems.

#### **TEXT BOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts"ll, 10<sup>th</sup> Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5<sup>th</sup> Edition, 2022 New Delhi.

#### **REFERENCES:**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, " Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7<sup>th</sup> Edition, Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

### CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	2	2	-	-	-	-	3	2	3	1	1	2	2
2	2	2	3	1	1	-	-	-	2	1	1	2	2	1	2
3	1	3	2	2	1	-	-	-	2	2	1	1	1	2	2
4	1	3	3	3	-	-	-	-	1	2	1	2	1	3	2
5	3	1	2	1	1	-	-	-	3	2	3	2	2	2	1
Avg.	2	2	2	2	1	-	-	-	2	2	2	2	1	2	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

GE3451

ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

L T P C

2 0 0 2

#### COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

#### UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

#### UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

#### UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

#### UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-

Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

**UNIT V            SUSTAINABILITY PRACTICES**

**6**

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

**CO1:**To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

**CO2:**To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

**CO3:**To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

**CO4:**To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

**CO5:**To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

**TEXT BOOKS:**

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

**REFERENCES :**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.



**NCC Credit Course Level 2\***

<b>NX3452</b>	<b>(NAVAL WING) NCC Credit Course Level - II</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
<b>PERSONALITY DEVELOPMENT</b>		
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
<b>LEADERSHIP</b>		
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
<b>DISASTER MANAGEMENT</b>		
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don'ts, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
<b>ENVIRONMENTAL AWARENESS &amp; CONSERVATION</b>		
EA 1	Environmental Awareness and Conservation	3
<b>GENERAL AWARENESS</b>		
GA 1	General Knowledge	4
<b>NAVAL ORIENTATION</b>		
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
<b>ADVENTURE</b>		
AD 1	Introduction to Adventure Activities	1
<b>BORDER &amp; COASTAL AREAS</b>		
BCA 1	History, Geography & Topography of Border/Coastal areas	2

**TOTAL: 45 PERIODS**

	<b>NCC Credit Course Level 2*</b> <b>(AIR FORCE WING) NCC Credit Course Level - II</b>	<b>L T P C</b>
<b>NX3453</b>		<b>3 0 0 3</b>

<b>PERSONALITY DEVELOPMENT</b>	<b>9</b>
PD 3      Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5      Public Speaking	3
<b>LEADERSHIP</b>	<b>7</b>
L 2      Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
<b>DISASTER MANAGEMENT</b>	<b>13</b>
DM 1      Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2      Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3      Fire Service & Fire Fighting	1
<b>ENVIRONMENTAL AWARENESS &amp; CONSERVATION</b>	<b>3</b>
EA 1      Environmental Awareness and Conservation	3
<b>GENERAL AWARENESS</b>	<b>4</b>
GA 1      General Knowledge	4
<b>GENERAL SERVICE KNOWLEDGE</b>	<b>6</b>
GSK 1      Armed Forces & IAF Capsule	2
GSK 2      Modes of Entry in IAF, Civil Aviation	2
GSK 3      Aircrafts - Types, Capabilities & Role	2
<b>ADVENTURE</b>	<b>1</b>
AD 1      Introduction to Adventure Activities	1
<b>BORDER &amp; COASTAL AREAS</b>	<b>2</b>
BCA 1      History, Geography & Topography of Border/Coastal areas	2

**TOTAL: 45 PERIODS**

<b>CS3461</b>	<b>OPERATING SYSTEMS LABORATORY</b>	<b>L T P C</b>
		<b>0 0 3 1.5</b>

#### **COURSE OBJECTIVES:**

- To install windows operating systems.
- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement various memory allocation methods.
- To be familiar with File Organization and File Allocation Strategies.

## **LIST OF EXPERIMENTS:**

1. Installation of windows operating system
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphore
7. Write C programs to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program
11. Write C programs to implement the following Memory Allocation Methods
  - a. First Fit
  - b. Worst Fit
  - c. Best Fit
12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs
  - a. Sequential
  - b. Indexed
  - c. Linked
15. Write C programs for the implementation of various disk scheduling algorithms
16. Install any guest operating system like Linux using VMware.

**TOTAL:45 PERIODS**

## **COURSE OUTCOMES:**

**At th end of this course, the students will be able to:**

- CO1 :** Define and implement UNIX Commands.  
**CO2 :** Compare the performance of various CPU Scheduling Algorithms.  
**CO3 :** Compare and contrast various Memory Allocation Methods.  
**CO4 :** Define File Organization and File Allocation Strategies.  
**CO5 :** Implement various Disk Scheduling Algorithms.

## **CO's-PO's & PSO's MAPPING**

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	1	1	-	-	-	1	3	3	3	2	1	3
2	3	1	1	2	2	-	-	-	3	2	1	1	3	1	2
3	3	3	2	1	2	-	-	-	3	3	1	2	2	2	2
4	1	2	2	3	2	-	-	-	3	1	3	1	1	2	1
5	2	2	1	1	3	-	-	-	1	2	2	3	1	3	3
<b>AVg.</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>						

**1 - low, 2 - medium, 3 - high, “-” no correlation**

**COURSE OBJECTIVES:**

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

**LIST OF EXPERIMENTS:**

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features
13. Case Study using any of the real life database applications from the following list
  - a) Inventory Management for a EMart Grocery Shop
  - b) Society Financial Management
  - c) Cop Friendly App – Eseva
  - d) Property Management – eMall
  - e) Star Small and Medium Banking and Finance
    - Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
    - Apply Normalization rules in designing the tables in scope.
    - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
    - Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings

**TOTAL: 45 PERIODS****COURSE OUTCOMES:****At the end of this course, the students will be able to:****CO1:** Create databases with different types of key constraints.**CO2:** Construct simple and complex SQL queries using DML and DCL commands.**CO3:** Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.**CO4:** Create an XML database and validate with meta-data (XML schema).**CO5:** Create and manipulate data using NOSQL database.