# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

## Scheme of Instruction of III Semester of B.E. - Artificial Intelligence and Data Science as per AICTE Model Curriculum with effect from 2023-24

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**SEMESTER – III**

| S.NO | Course Code | Title of the Course | Scheme of Instruction | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | Hours per Week | | Duration of SEE in Hours | Maximum Marks | | |
| | | | L/T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | |
| 1. | 22MTC07 | Mathematical and Statistical Foundations | 3 | - | 3 | 40 | 60 | 3 |
| 2. | 22CSC15 | Operating Systems | 3 | - | 3 | 40 | 60 | 3 |
| 3. | 22CSC11 | Database Management Systems | 3 | - | 3 | 40 | 60 | 3 |
| 4. | 22ITC02 | Java Programming | 3 | - | 3 | 40 | 60 | 3 |
| 5. | 22ITC01 | Digital Logic and Computer Architecture | 3 | - | 3 | 40 | 60 | 3 |
| 6. | 22CSC05 | Data Structures | 3 | - | 3 | 40 | 60 | 3 |
| 7. | 22EGM01 | Indian Constitution and Fundamental Principles | 2 | - | 2 | - | 50 | NC |
| **PRACTICAL** | | | | | | | | |
| 8. | 22CSC33 | DBMS Lab | - | 2 | 3 | 50 | 50 | 1 |
| 9. | 22ITC03 | Java Programming Lab | - | 2 | 3 | 50 | 50 | 1 |
| 10. | 22CSC31 | Data Structures Lab | - | 2 | 3 | 50 | 50 | 1 |
| 11. | 22ADI01 | MOOCs/Training/Internship | 2-3 Weeks/ 90 Hours | | - | - | - | 2 |
| **TOTAL** | | | **20** | **6** | **29** | **390** | **500** | **23** |

**L: Lecture T: Tutorial D: Drawing P: Practical**
**CIE – Continuous Internal Evaluation SEE - Semester End Examination**

**22MTC07**

# Mathematical and Statistical Foundations

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of Semester End Examination | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Course Objectives:**

1. Able to learn and analysing data in using statistical tools.
2. Able to fit the hypothetical data using probability distribution.
3. Able to fit the random data using distribution function.
4. Able to understand the data using the testing of Hypothesis.
5. Able to understand the basic concepts of the Number Theory for data security.

**Course Outcomes**:

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

1. Apply the statistical averages for identifying behaviour of the data.
2. Analyse the data using probabilistic models.
3. Apply the probability function to characterise the random phenomenon.
4. Analyse data using different methods of hypothesis testing.
5. Apply the number theory concept to cryptography domain.

**Mapping of Course Outcomes with program Outcomes and Program Specific Outcomes:**

| PO/PSO CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 3 |
| **CO5** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 1 | 2 | 1 |

**UNIT-I: Basic Statistics**

Measures of Central Tendency, Measures of Dispersion, Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for frequency distribution, Kurtosis. Correlation, linear regression, properties of regression coefficient.

**UNIT-II: Mathematical Expectation (One Dimensional Random variables)**

Conditional Probability, Baye's theorem. Random variable, discrete random variable, Probability Mass Function, continuous random variable, probability density function. Mathematical expectation, properties of Expectation, Variance and co-variance. Moments (Moments about the mean and moments about a point).

**UNIT-III: Probability Distributions**

Poisson distribution, Mean, Variance, MGF and CGF, Recurrence formula for the probabilities of Poisson distribution (Fitting of Poisson distribution). Normal distribution, Characteristics of normal distribution, Mean, Variance, MGF and CGF, Areas under normal curve. Uniform distribution, Mean, Variance and MGF, Exponential distribution, Mean, Variance, MGF and CGF.

**UNIT-IV: Testing of Hypothesis**

Large and Small Sample Tests: Tests of significance for large samples, for Single Proportion, difference of Proportions, Single mean and difference of means. Small sample test: t-test for single mean and differences of means. F-test for equality of two population variances.

**UNIT-V: Number Theory**

Greatest common divisors, The Euclidean algorithm, the fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers. Introduction to Congruence, Linear congruence, The Chinese Remainder Theorem, System of linear congruences.

**Text Books:**

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Kenneth H. Rosen, Elementary number theory & its applications, Sixth edition, Addison-wesley, ISBN978 0-321-50031-1.

**Suggested Reading:**

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.
2. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.
3. S.C.Gupta, V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.

## 22CSC15

# OPERATING SYSTEMS

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites**: Computer Architecture and Programming Fundamentals.

**Course Objectives**:
This course aims to:
1. Understand the basic concepts and design of an operating system.
2. Interpret the structure and organization of the file system
3. Learn Inter Process Communication mechanisms and memory management approaches.
4. Explore cloud infrastructures and technologies.

**Course Outcomes**:
Upon completion of this course, students will be able to:
1. Understand the basics of Operating systems and its major components.
2. Illustrate the concepts related to process management.
3. Distinguish various memory management techniques.
4. Apply concepts of process synchronization and deadlocks to a given situation.
5. Evaluate various file allocation methods and Apply security as well as recovery features in the design Operating system.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |
| **CO 2** | 3 | 3 | - | 3 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO 3** | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| **CO 4** | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| **CO 5** | 3 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 |

**UNIT – I**

**Introduction to Operating Systems:** Computer System overview, Components of a computer system, functions of OS, Examples, different types of OS (RTOS vs. desktop vs. mobile etc.), OS distributions and versions.

**OS architectures:** Micro-kernel, Layered, Kernel Approaches and examples.

**UNIT – II**

**Process management:** Program vs. process, process states, Process Control Block (PCB), OS services and system calls (fork, wait, exec, getpid, getppid etc.), system calls vs. System programs, Process scheduling-Process context switching, Scheduling algorithms, scheduling criteria.

**Inter Process Communication**: Linux IPC Mechanisms, RPC, RPC exception handling, Security issues.

**UNIT – III**

**Memory Management:** Memory view of a process, Process memory usage requirements, virtual and physical memory related system calls (mmap, munmap, sbrk, mprotect). Address translation mechanisms --- static mapping, segmentation, paging, page faults, page replacement algorithms, page sharing, read/write permissions, swapping.

**Secondary Memory Management**: Disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels.

**UNIT – IV**

**Concurrency and Synchronization:** Introduction to threads, benefits, types and thread APIs, Synchronization, issues, hardware and software solutions for synchronization, Classical problems of synchronization.

**Deadlocks**: Introduction, necessary conditions for deadlock occurrence, RAG, deadlock handling mechanisms - prevention, avoidance, and recovery.

**UNIT - V**

**File Systems:** File concepts, file types, allocation and organization methods, file handling system calls, File system metadata, directory structure, caching optimizations File Systems case study.

**OS Security:** Types of threats in OS, basic security mechanisms, malware taxonomy, viruses, worms, and rootkits; Defense: overview, logging, auditing, and recovery, OS-level memory protection.

**Text Books:**

1. Galvin, Silberschatz, "Operating system Concepts", 10th Edition, John Wiley & Sons, 2018.
2. Maurice J. Bach, "Design of the UNIX Operating System", Pearson Education India; 1st Edition, 2015.
3. Ekta Walia Khanna ,"Operating System Concepts", Publishing House; 2nd Edition,2019.
4. Dhananjay Dhamdhare, "Operating Systems-A Concept Based Approach", 3rd Edition, McGraw Hill Education, 2017.

**Suggested Reading:**

1. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX® Environment" Pearson Education India; 3rd Edition, 2013.

**Online Resources:**

1. Remzi H. Arpaci-Dusseau and Andrea C. , "Three Easy Pieces", Arpaci-Dusseau Arpaci-Dusseau Books, LLC https://pages.cs.wisc.edu/~remzi/OSTEP/ (online version)
2. Frans Kaashoek, Robert Morris, and Russ Cox, Xv6, a simple Unix-like teaching operating system [T4-R] https://github.com/mit-pdos/xv6-riscv (RISC-V version) [T4-X] https://github.com/mit-pdos/xv6-public (x86 version)

**22CSC11**

# DATA BASE MANAGEMENT SYSTEMS

| | |
|---|---|
| Instruction | 3L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Discrete mathematics of computer science, Programming and Data Structures.

**Course Objectives:**
This course aims to:
1. Familiarize students with fundamental concepts of database management. These concepts include aspects ofdatabase design, database languages and database-system implementation.
2. Understand about data storage techniques and indexing.
3. Impart knowledge in transaction management, concurrency control techniques and recovery procedures.

**Course Outcomes:**
Upon completion of this course, students will be able to:
1. Design database schema for an application using RDBMS concepts.
2. Write SQL queries for tasks of various complexities.
3. Build applications using database system as backend.
4. Understand internal working of a DBMS including data storage, indexing, query processing, transaction processing, concurrency control and recovery mechanisms.
5. Analyze non-relational and parallel/distributed data management systems with a focus on scalability.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 1 | 1 | 2 | 2 |
| **CO 2** | 2 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 1 | 2 | 2 | 2 |
| **CO 3** | 2 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 4** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| **CO 5** | 2 | 1 | - | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 3 |

**UNIT - I**
**Introduction:** Motivation, Introduction to Data Models (Relational, Semi structured, ER).
**Relational Data Bases:** Relational Data Model, Relational Algebra, Relational Calculus.

**UNIT - II**
**SQL + Interaction with Database:** SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL. Simple Queries (select/project/join/ aggregate queries), Complex queries (With Clause, Nested Subqueries, Views), Programming in a standard language and interfacing with a DB backend.

**UNIT- III**
**Big Data:** Key-value Stores and Semi structured Data, using JSON and MongoDB, or other combinations
**Database Design:** Introduction to ER model, Mapping from ER to relational model, Functional Dependencies, Normalization.

**UNIT - IV**

**Physical Design:** Overview of Physical Storage (Hard Disks, Flash/SSD/RAM), sequential vs random I/O, Reliability via RAID, Storage Organization (Records, Pages and Files), Database Buffers, Database Metadata, Indexing, B+-Trees.

**UNIT - V**

**Query Processing and Optimization:** Query Processing, External sort, Joins using nested loops, indexed nested loops.

**Overview of Query Optimization:** Equivalent expressions and concept of cost based optimization.

**Transaction Processing:** Concept of transactions and schedules, ACID properties, Conflict-serializability, C**oncurrency control:** locks, 2PL, Strict 2PL, optional: isolation levels, Recovery using undo and redo logs.

**Text Books:**

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill. Indian Edition, 2021
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Pubs, 2017
3. Lemahieu, Broucke and Baesens, "Principles of Database Management", Cambridge University Press, 2018
4. RP Mahapatra, "Database Management Systems", Khanna Publishing House, 2020.
5. Krishnan, "Database Management Systems", McGraw Hill.

**Suggested Reading:**

1. MySQL Explained: Your Step By Step Guide To Database Design
2. Pro SQL Server 2008 Relational Database Design and Implementation (Expert's Voice in SQL Server) 1st Edition

**Online Resources:**

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html.
2. https://www.oracle.com/news/connect/json-database-semistructured-sql.html

**22ITC01**

## DIGITAL LOGIC AND COMPUTER ARCHITECTURE

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:**

1. To familiarize with logic gates, combinational and Sequential logic circuits.
2. To provide understanding of Digital Counters, registers and Data representation.
3. To present the operation of the Central Processing Unit.
4. To facilitate the techniques that computers use to communicate with input and output devices.
5. To introduce the concept of memory hierarchy and memory management.

**Course Outcomes:**

On Successful completion of this course, student will be able to:

1. Apply Boolean algebra for simplification and learn representation of data using numbers.
2. Understand fundamentals of combinational & sequential logic gates, registers and counters.
3. Infer the architecture and functionality of the central processing unit.
4. Explore the techniques that computers use to communicate with I/O devices for data transfer.
5. Comprehend memory hierarchy, cache memory and virtual memory.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

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

**UNIT–I**

**Data Representation:** Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Complements: (r-1)'s Complement, r's Complement, Subtraction of Unsigned Numbers, Fixed–Point Representation, and Floating –Point Representation.

**Digital Logic Circuits :** Digital Computers, Logic Gates, Boolean Algebra, Map simplification, Product –of-sums Simplification, Don't –Care Conditions.

**UNIT–II**

**Combinational Circuits**: Decoders, Encoders, Multiplexers, Half-Adder, Full–Adders, **Flip-Flops:** SR, D, JK, T Flip- Flops, Edge triggered Flip-Flops, Excitation Tables.

**Registers:** Register with Parallel load, Bidirectional Shift Register with Parallel load, 4-bit Synchronous Binary Counter.

**UNIT–III**

**Central Processing Unit:** General register Organization, Instruction Formats: Three Address Instructions, Two-Address Instructions, One-Address Instructions, and Zero-Address Instructions. Addressing Modes: Data Transfer and Manipulation, Program Control, Multi core Processors and their Performance.8851

**UNIT–IV**

**Input-Output Organization:** Peripheral Devices: ASCII Alphanumeric Characters, Input-output Interface: I/O Bus and Interface Modules, Asynchronous Data Transfer: Strobe Control, Handshaking, Asynchronous Communication Interface, First-In- First-Out Buffer, Modes of Transfer: Interrupt-Initiated I/O, Priority Interrupt: Daisy Chaining, Parallel Priority Interrupt, Priority Encoder, Direct Memory Access (DMA): DMA Controller.

**UNIT–V**

**Memory Organization:** Memory Hierarchy, Main Memory: RAM and ROM Chips, Memory Address Map, Memory Connection to CPU, Auxiliary memory: Magnetic Disks, Solid State Drive, Associative Memory: Hardware Organization, Read and Write Operations, Cache Memory: Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory: Address Space and Memory Space, Address Mapping using Pages, Associative Memory Page Table.

**Text Book:**

1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education. 2016.

**Suggested Reading:**

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL design", 2nd Edition, McGraw Hill, 2009.
2. ZVI Kohavi, "Switching and Finite Automata Theory", 2nd Edition, Tata McGraw Hill, 1995.
3. William Stallings, "Computer Organization and Achitecture", 8th Edition, PHI.2010
4. Carl Hamachar, Vranesic, Zaky, "Computer Organization", 5th Edition, McGraw Hill.2002.

**Web Resources:**

1. https://nptel.ac.in/courses/117106114Week1%20Slides1.1Introduction.pdf
2. https://ece.gmu.edu/coursewebpages/ECE/ECE545/F10/viewgraphs/ECE545_lecture1_digital_logic_review.ppt
3. http://www.nptelvideos.in/2012/11/computer-organization.html

**22ITC02**

## JAVA PROGRAMMING

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:**

1. Deliver the Object-oriented programming features and principles for code development.
2. Explore the reusability of the code, coupling and cohesion.
3. Handle the exceptions and multiple flow of the execution.
4. Understand the collection framework.
5. Develop the database applications.

**Course Outcomes:**

On Successful completion of this course, students will be able to:

1. Apply the concept of OOP to design, implement and execute programs.
2. Use the strings, interfaces, packages and inner classes for application development.
3. Apply the exception handling mechanisms and multithreading for the development.
4. Develop applications using collection framework.
5. Develop database applications using SQL package.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

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

**UNIT-I**

**Introduction to Java:** Procedural and object-oriented programming paradigms, Principles, Features, Basic structure a java program, Java Primitive Data Types, Basic Operators, Flow-control statements. Defining Classes, Adding Instance Fields and Methods, Object Creation, Constructors, Access Modifiers, Method Overloading and Constructor Overloading, Use of static and final keyword, Arrays, Strings and String Tokenizer.

**UNIT-II**

**Inheritances and Packages:** Types of Inheritance, super keyword, preventing inheritance, the Object class, method overriding and dynamic method dispatch, abstract classes and methods. Interfaces, Interfaces vs. Abstract classes, Inner classes and types, Packages, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

**UNIT-III**

**Exception Handling and Threading:** What are exceptions, Error vs. Exception, usage of try, catch, throw, throws and finally clauses.Multithreading in Java, Life cycle of Thread, how to create threads, Thread class in java, Thread priorities, Thread Synchronization. Introduction to Generics.

**UNIT-IV**

**Collections:** Overview of Java Collection Framework, Collection Interfaces – Collection, Set, List, Map, Collection classes – Array List, Linked List, Hash Set, Tree Set, Hash Map, Tree Map, legacy and class, Iteration over Collections – Iterator and List Iterator, Enumeration interfaces, differentiate Comparable and Comparator interface, Introduction to Java 8 Features.

**UNIT-V**

**Servlets,JSP and Databases:** Introduction to Servlets , Servlet Life cycle, Request and Response methods-Servlet Collaboration. Servlet Config vs. Servlet Context, JSP, Databases: Connecting to Database - JDBC, Drivers, Connection, Statement and its types, Result set, CRUD operations.

**Text Books:**

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram "Advanced Programming in Java2" Jaico Publishing House, 2008.
3. Bruce W.perry "Java Servlet and JSP Cookbook", O'reilly Media Inc., 2004.

**Suggested Reading:**

1. Sachin Malhotra, Saurabh Choudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.
2. C.ThomasWu, "An Introduction to Object-Oriented Programming with Java", TataMcGraw-Hill, 4th Edition, 2010.
3. E Balaguruswamy "Programming with Java", TataMcGraw-Hill, 6th Edition, 2019.
4. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I— Fundamentals", 8th Edition, Prentice Hall, 2008.
5. K Somasundaram "Introduction to Java Programming" , Jaico Publishing House, 2016.
6. Paul Deitel and Harvey Deitel "Java How to Program, Early Objects ", 11th Edition., 2018.

**Web Resources:**

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

**22CSC05**

# DATA STRUCTURES

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites**: Basic knowledge of programming language such as python.

**Course Objectives:**
This course aims to:
1. Study various linear and non-linear data structures.
2. Understand the performance of operations on data structures.
3. Explore various searching and sorting techniques.

**Course Outcomes:**
Upon completion of this course, students will be able to:
1. Understand the basic concepts and types of data structures.
2. Analyze various linear and nonlinear data structures.
3. Identify the applications of linear and nonlinear data structures and significance of balanced search trees, hashing.
4. Evaluate various searching and sorting techniques.
5. Use appropriate data structures to design efficient algorithms.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 2** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 3** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| **CO 4** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 5** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |

**UNIT-I**
**Introduction:** Data structures, Classification of data structures, Abstract Data Types, Analysis of Algorithms; **Recursion**: Examples illustrating Recursion (Factorial, Binary Search), Analyzing Recursive Algorithms; **Sorting:** Quick sort, Merge Sort, Selection Sort, Radix sort, Comparison of Sorting Algorithms.

**UNIT–II**
**Stacks:** Stack ADT, Applications of stack, Array based stack implementation**; Queues:** Queue ADT, applications of queues, Array based queue implementation, Double Ended Queues, Circular queues.

**UNIT-III**
**Linked Lists:** Introduction, Linked lists, Representation of linked list, types of linked list, singly linked lists, implementing stack with a singly linked list and Queue, Circular linked lists, doubly linked lists, Applications of linked lists.

**UNIT-IV**
**Trees:** General Trees, Binary Trees, Implementing Trees, Tree traversals; **Search Trees:** Binary Search Trees, Balanced search trees- AVL trees, B- trees; **Priority Queue and Heaps:** Priority queue ADT, Priority queue applications, Heap Trees, implementing a priority queue with a Heap, Heap Sort.

**UNIT-V**

**Graphs:** Introduction, Applications of graphs, Graph representations, graph traversals.

**Hashing:** Introduction, Hash Functions-Modulo, Middle of Square, Folding, Collision Resolution Techniques-Separate Chaining, Open addressing,- LinearProbing, Quadratic Probing, Double Hashing.

**Text Books:**

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structure and Algorithms in Python", Wiley, 2021.
2. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2020
3. S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", E. Horowitz, Universities Press, 2nd Edition, .
4. Reema Thareja, "Data Structures using C", Oxford University Press, 2nd Edition, 2014.

**Suggested Reading:**

1. D. S. Kushwaha and A K. Misra, "Data structures A Programming Approach with C", PHI, 2nd edition, 2014.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, MGH, Kindle Edition, 2017.
3. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018
4. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013

**Online Resources:**

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-#DS
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.coursera.org/specializations/data-structures-algorithms

**22EGM01**

# INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

| | |
|---|---|
| Instruction | 2 L Hours per week |
| Duration of End Examination | 2 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | - |
| Credits | 0 |

**Prerequisite:** Basic Awareness of Indian Constitution and Government.

**Course Objectives**

**The course will introduce the students to:**

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary
5. Educate on the local governance and problems in development of rural and urban areas.

**Course Outcomes**

**After successful completion of the course the students will be able to:**

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | - | - | 1 | - | - | 1 | 1 | 1 | 1 | - | - | - | - | - | - |
| **CO 2** | - | - | 2 | - | - | 3 | 2 | 2 | 1 | - | - | - | - | - | - |
| **CO 3** | - | - | 1 | - | - | 1 | 1 | - | - | - | - | - | - | - | - |
| **CO 4** | - | - | 1 | - | - | 1 | 1 | - | - | - | - | - | - | - | - |
| **CO 5** | - | - | 2 | - | - | 3 | 2 | 1 | 1 | - | - | - | - | - | - |

**Unit-I**

**Constitutional History and Framing of Indian Constitution**

East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

**Unit-II**

**Fundamental Rights, Duties and Directive Principles of State Policy**

The Fundamental Rights**:** Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

**Unit-III**

**Union Government and its Administration**

Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

**Unit-IV**

**Union Legislature and Judiciary**

Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

**Unit-V**

**Local Self Governments**

Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

**Text Books:**

1. Sastry Ravindra, (Ed), "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. "Indian Constitution at Work", NCERT, First edition 2006, Reprinted in 2022.

**Suggested Reading:**

1. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. Granville Austin, "The Indian Constitution: The Cornerstone of a Nation", OUP, 2nd Edition, 1999.
4. M.V. Pylee, "India's Constitution", S. Chand Publishing, 16th Edition, 2017.
5. Rajeev Bhargava (ed), "Politics and Ethics of the Indian Constitution", OUP, 2008.

**Online Resources:**

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

**22CSC33**

## DATA BASE MANAGEMENT SYSTEMS LAB

| | |
|---|---|
| Instruction | 2 P Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Course Objectives:**

This course aims to:

1. Become familiar with the concepts of structured query language.
2. Understand about programming language / structured query language (PL/SQL).
3. Become familiar with generation of form and open database connectivity.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

**Course Outcomes:**

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

1. Outline the built-in functions of SQL and apply these functions to write simple and complex queries usingSQL operators.
2. Demonstrate Queries to Retrieve and Change Data using Select, Insert, Delete and Update. ConstructQueries using Group By, Order By and Having Clauses.
3. Demonstrate Commit, Rollback, Save point commands, SQL Plus Reports and formulate the Queries forCreating, Dropping and Altering Tables, Views, constraints.
4. Develop queries using Joins, Sub-Queries and Working with Index, Sequence, Synonym, ControllingAccess and Locking Rows for Update, Creating Password and Security features.
5. Develop PL/SQL code using Cursors, Exception, Composite Data Types and Procedures, Functions andPackages.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 3 | - | - | - | 2 | - | 1 | 3 | 1 | 2 | 2 |
| **CO 2** | 3 | 3 | 2 | 3 | 3 | - | - | - | 2 | - | 1 | 3 | 2 | 2 | 2 |
| **CO 3** | 3 | 2 | 2 | 2 | 3 | - | - | - | 2 | - | 1 | 1 | 2 | 2 | 3 |
| **CO 4** | 3 | 1 | 1 | 1 | - | - | - | - | 2 | - | 1 | - | 1 | 2 | 3 |
| **CO 5** | 3 | 1 | - | 1 | - | - | - | - | 1 | - | 1 | - | 2 | 2 | 3 |

**List of Experiments**

### SQL:

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, DataFunctions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.

9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update,
10. Creating Password and Security features.
11. Querying in NoSql

**PL/SQL:**

1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

**Note:** The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

**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.

**22ITC03**

# JAVA PROGRAMMING LAB

| | |
|---|---|
| Instruction | 2 P Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Course Objectives:**

1. To deliver the basic principles of OOP.
2. To explore the object-orientation process in creating classes, object, etc.,
3. To demonstrate the inheritances and polymorphism.
4. To handle the exceptions in runtime and multithreading.
5. To develop the database applications.

**Course Outcomes:**

On Successful completion of this course, student will be able to:

1. Practice the basics of OOPs to develop java applications.
2. Use the inheritance and interfaces for application development.
3. Apply the exception handling and multithreading to handle multiple flows of execution.
4. Develop applications using collection framework.
5. Apply the SQL concepts for application development.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

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

## LIST OF EXPERIMENTS

1. Implement the program(s) to handle the various data types, operators, expressions, control-flow, and strings.
2. Develop a java program(s) for dynamic method dispatch and constructor.
3. Develop a java program(s) to deal with different types of inheritances and interfaces.
4. Implement the program(s) to demonstrate the packages.
5. Develop a java program(s) to handle user defined exceptions with multiple catch blocks.
6. Implement program(s) to demonstrate Multithreading and thread synchronization.
7. Implement the collection framework classes with Iterator/ListIterator/Enum Interface.
8. Develop a java program(s) to implement the features of JDK8.
9. Implement a java program(s) to implement the concept of Servlets and JSP.
10. Create a web application to implement CRUD operations using Servlets, JSP and Databases.

**Text Books:**

1. Herbert Schildt, “Java: The Complete Reference”, 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram “Advanced Programming in Java2” Jaico Publishing House, 2008.
3. Bruce W.perry “Java Servlet and JSP Cookbook”, O’reilly Media Inc., 2004.

**Suggested Reading:**

1. Sachin Malhotra, Saurabh Choudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.
2. C.ThomasWu, "An Introduction to Object-Oriented Programming with Java", TataMcGraw-Hill, 4th Edition, 2010.
3. E Balaguruswamy "Programming with Java", TataMcGraw-Hill, 6th Edition, 2019.
4. Cay S. Horstmann, Gary Cornell," Core Java, Volume I— Fundamentals", 8th Edition, Prentice Hall, 2008.
5. K Somasundaram "Introduction to Java Programming" , Jaico Publishing House, 2016.
6. Paul Deitel and Harvey Deitel "Java How to Program, Early Objects", 11th Edition., 2018.

**Web Resources:**

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

**22CSC31**

# DATA STRUCTURES LAB

| | |
|---|---|
| Instruction | 2 P Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites:** Any Programming Language.

**Course Objectives:**

**This course aims to:**

1. Understand the basic concepts of data structures and abstract data types.
2. Explore linear and non-linear data structures.
3. Study various searching, sorting and hashing techniques.

**Course Outcomes:**

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

1. Implement the abstract data type.
2. Implement linear and non-linear data structures.
3. Evaluate various sorting techniques.
4. Analyze various algorithms of linear and nonlinear data structures.
5. Choose or create appropriate data structures to solve real world problems.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 2** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 3** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| **CO 4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 5** | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |

**List of Experiments**

1. Implementation of Quick sort, Merge sort and Selection sort.
2. Implementing Stack using array.
3. Conversion of Infix expression to Postfix expression.
4. Implement the algorithm for Evaluation of Postfix.
5. Implementing Queues using array
6. Implementation of Insert, Delete and Display operations on Single Linked List.
7. Implementation of Stack and Queue using linked list.
8. Implementation of Insert, Delete and Display operations on doubly Linked List.
9. Implementation of Binary Search Tree operations.
10. Implementation of Heap Sort.

**Text Books:**

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2021.
2. Narasimha karumanchi, “Data Structures and Algorithms Made Easy”, Career Monk Publications, 2020.

**22ADI01**

## MOOCS / TRAINING / INTERNSHIP

| | |
|---|---|
| Instruction/Demonstration/Training | 3-4 Weeks/90 Hours |
| Duration of Semester End Presentation | -- |
| Semester End Evaluation | 60 Marks |
| Mid Term Evaluation | 40 Marks |
| Credits | 2 |

**Prerequisite:** Knowledge of basic Sciences

MOOCs/Training/Internship Objectives: This MOOCs/Training/Internship aims to:

1.
2.
3.

MOOCs/Training/Internship Outcomes:

Upon completion of this MOOCs/Training/Internship, students will be able to:

1.
2.
3.
4.
5.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | | | |
| **CO 2** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | | | |
| **CO 3** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | | | |
| **CO 4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | | | |
| **CO 5** | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | | | |

# Refer Internship Policy Document

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

**Scheme of Instruction of IV Semester of B.E. - Artificial Intelligence and Data Science as per AICTE Model Curriculum with effect from 2023-24**

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**SEMESTER – IV**

| NO | Course Code | Title of the Course | Scheme of Instruction | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | Hours per Week | | Duration of SEE in Hours | Maximum Marks | | |
| | | | L/T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | |
| 1. | 22MTC16 | Stochastic Process and Queueing Theory | 3 | - | 3 | 40 | 60 | 3 |
| 2. | 22ECC39 | Systems and Signal Processing | 3 | - | 3 | 40 | 60 | 3 |
| 3. | 22CSC14 | Design and Analysis of Algorithms | 3 | - | 3 | 40 | 60 | 3 |
| 4. | 22ADC01 | Fundamentals of Machine Learning | 3 | - | 3 | 40 | 60 | 3 |
| 5. | | Professional Elective – I | 3 | - | 3 | 40 | 60 | 3 |
| 6. | 22MBC01 | Engineering Economics and Accountancy | 3 | - | 3 | 40 | 60 | 3 |
| 7. | 22CEM01 | Environmental Science | 2 | - | 2 | - | 50 | NC |
| **PRACTICAL** | | | | | | | | |
| 8. | 22MTC17 | Stochastic Process and Queueing Theory Lab | - | 2 | 3 | 50 | 50 | 1 |
| 9. | 22CSC34 | Design and Analysis of Algorithms Lab | - | 2 | 3 | 50 | 50 | 1 |
| 10. | 22ADC02 | Machine Learning Lab | - | 2 | 3 | 50 | 50 | 1 |
| 11. | 22ADC04 | Linux and Latex Lab | - | 2 | 3 | 50 | 50 | 1 |
| | | | **20** | **8** | **32** | **440** | **550** | **22** |

**L: Lecture T: Tutorial D: Drawing P: Practical**
**CIE – Continuous Internal Evaluation SEE - Semester End Examination**

| | | | | | |
|---|---|---|---|---|---|
| **Professional Elective #1** | Digital Image Processing (22ITE02) | Web Technologies (22ITC17) | Mobile Application Development (22ITE04) | Data Analysis and Visualization (22ADE01) | Data Warehousing and Data Mining (22ADE02) |

**22MTC16**

## Stochastic Process and Queueing Theory

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives**:
1. Able to learn methods to solve bivariate probability functions.
2. Able to know characterizing the random process.
3. Able to identify the tools for interpretating the random process.
4. Able to know the statistical techniques for random process.
5. Able to analyses the queuing models.

**Course Outcomes:**
On successful completion of this course the students shall be able to
1. Estimate the marginal probabilities of statistical averages.
2. Distinguish the random process of auto correlation and cross correlation.
3. Characterize the random process of ensemble averages.
4. Analyze the effect the thermal noise in the system.
5. Analyze the queuing behavior of different queuing models.

### Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 2** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 3** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 4** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 5** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |

**UNIT-I: Two-Dimensional Random Variables**
Two-dimensional or Joint Probability Mass Function, Two-dimensional Distribution Function, Marginal Distribution Functions, Joint Density Function, Marginal Density Function, The Conditional Distribution Function and Conditional Probability Density Function, Stochastic Independence ,Generalization of n dimensional random variable, transformation of One-dimensional Random variable, transformation of Two-dimensional random variable.

**UNIT-II: Random Processes**
Classification of Random Processes, Methods of Description of a Random Process, Special classes of Random Processes, Average values of Random Process, Stationarity, Strict Strong Stationary process, Analytical Representation of a Random process, Autocorrelation Function and Its properties of R(t),Cross-Correlation Function and its Properties wide sense stationary process.

**UNIT-III: Discrete Time Process**
Ergodicity, Mean-Ergodic Process, Mean Ergodic Theorem, Correlation Ergodic Process, Distribution Ergodic Process, Power Spectral density function, Properties of power spectral Density function, Properties of Power Spectral Density Function, System in the Form of Convolution, Unit Impulse Response of the System, Properties.

**UNIT-IV: Applications of Random Process**

Definition of Gaussian process, Properties, Band Pass Process, Narrow-Band Gaussian process, Property, Noise, Thermal noise, Filters, Poisson process, Probability law of Poisson process, Mean and Autocorrelation of the Poisson process, Properties of Poisson process, Markov process, Definition of a Markov chain and Transition Probabilities.

**UNIT-V: Queueing Theory**

Introduction-Queueing system-The arrival pattern-The service pattern-The queue discipline, Symbolic Representation of a Queueing Model –Characteristics of Infinite Capacity, Single server Poisson Queue Model Queueing problem-Pure Birth and Death Process-Probability Distribution of Departures(pure death process)-Basic queueing Models-Measures of the (M/M/1):$(\infty/FIFO)$ $model$-Characteristic of Finite Capacity, Single Server Poisson Queue Model III (M/M/1):$(N/FCFS)$ Model.

**Text Books**

1. "Probability Statistics and Random Processess" by T Veerarajan,2nd Edition Tata McGraw-Hill.
2. "Fundamentals of Mathematical Statistics" by V.K.Kapoor & S.C.Gupta 11th revised Edition Sultan chand & Sons.

**Suggested Reading:**

1. "Stochastic Process and Queueing Theory" by Randolph Nelson 1995,Ist edition, Springer- verlag Newyork.

**22ECC39**

# Systems and Signal Processing

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Prerequisite:** Knowledge of Differential and Integral Calculus.

**Course Objectives:**
This course aims to:
1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFT, DFT and Z-Transforms.
3. Understand concepts of convolution integrals.

**Course Outcomes:**
Upon completion of this course, students will be able to:
1. Classify signals, analyse the signals using Transform techniques.
2. Evaluate signal characteristics in frequency domain.
3. Assess the system stability and causality using ROC and Pole-Zero Plot.
4. Classify systems and analyse the signals using Transform techniques
5. Describe and analyse the DT Signal/systems using DFT, DCT, DWT, FFT and Z-Transform.

**Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:**

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 1 | - | - | - |
| **CO 2** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | - | - | - |
| **CO 3** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | - | - | - |
| **CO 4** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 1 | - | - | - |
| **CO 5** | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 | - | - | - |

**UNIT-I**
**Continuous Time Signals**: Introduction to signals, signal representations and classification.
**Fourier Series:** Exponential Fourier series, Amplitude and Phase spectra. Power Spectral Density.

**UNIT-II**
**Fourier Transforms:** Direct Fourier transforms, Inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, FT of basic signals, Energy Spectral Density.

**UNIT-III**
**Laplace Transforms:** Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals.

**UNIT-IV**
**Z–Transform:** Direct Z-Transform, Region of convergence and its properties. Z–Transform properties. Inverse Z–Transform, Discrete Fourier Transform, Properties of Discrete Fourier Transform, FFT, DCT and DWT

**UNIT-V**

**Continuous & Discrete Systems:** Introduction to systems, System classifications-Linear, Causal, Stable, Time-invariant, Impulse response, System transfer function, Distortion less system, Non-linear systems- Filters

**Text Books:**

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition,2009.

**Suggested Reading:**

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M. J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.

**22CSC14**

# DESIGN AND ANALYSIS OF ALGORITHMS

| | |
|---|---|
| Instruction | 3L Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Pre-requisites:** Basics of Data structures and algorithms.

## Course Objectives:

This course aims to:

1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

## Course Outcomes:

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

1. Analyzing performance of algorithms using asymptotic notations.
2. Demonstrate familiarity with major algorithms and importance of algorithm design techniques.
3. Apply algorithm design techniques on different problems.
4. Analyze the efficiency of the algorithms.
5. Understanding limits of efficient computation with the help of complexity classes.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 2 |
| **CO 2** | 3 | 3 | 2 | - | 1 | - | - | - | 1 | - | 1 | 1 | 1 | 2 | 3 |
| **CO 3** | 3 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 1 | - | 1 | 2 | 3 |
| **CO 4** | 3 | 3 | 2 | 2 | 2 | - | 1 | - | 1 | - | - | - | 1 | 2 | 3 |
| **CO 5** | 3 | 2 | 2 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | 1 | 2 | 3 |

**UNIT-I**

**Introduction:** Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds–best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Divide and Conquer:** The general method. **Analysis of recursive algorithms through recurrence relations:** Substitution method, Recursion tree method and Masters' theorem, Randomized Quicksort.

**UNIT-II**

**Greedy Algorithms**: The general method, Knapsack Problem, Huffman Codes, Job Scheduling with Deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix Chain Multiplication, Longest Common Subsequence, Optimal Binary Search Tree.

**UNIT-III**

**Backtracking:** The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO Branch and Bound, LC Branch and Bound, 0/1 Knapsack Problem, Travelling Salesperson problem.

**UNIT-IV**

**Graph Algorithms: Applications of DFS**: Bi-Connected components, Strongly Connected Components, Topological Sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall and Johnson's algorithms. **Minimum Spanning Tree Algorithms**: Prims and Kruskal.

**UNIT-V**

**Theory of NP-Completeness:** Polynomial Time, Polynomial Time Verification, P, NP, NP-Hard and NP-Complete Classes, NP-Completeness and Reducibility. **Standard NP-Complete Problems and Reduction Techniques:** The Clique Problem, Vertex-Cover and Subset Sum Problem.

**Text Books:**

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 3rd Edition, 2009.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms",Universities Press, 2008.

**Suggested Reading:**

1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

**Online Resources:**

1. https://nptel.ac.in/courses/106101060/

**22ADC01**

# FUNDAMENTALS OF MACHINE LEARNING

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Course Objectives:**

This course aims to:

1. To impart knowledge on the basic concepts of machine learning.
2. To familiarize different machine learning techniques.
3. To learn various Classification and Regression algorithms.
4. To familiarize various Kernels, SVMs and Ensemble methods.
5. To facilitate Dimensionality Reduction and Clustering.

**Course Outcomes:**

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

1. Explain the types of machine learning and handle the challenges of machine learning.
2. Construct Decision Trees, Measure performance of classifiers.
3. Apply Regression, Logistic Regression and gradient descent to solve problems.
4. Design solutions using Bayesian classifier, SVMs and Ensemble methods.
5. Perform Dimensionality reduction and clustering of data.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | - | 1 | - | 2 | - | - | - | - | - | - | - | 1 | 2 | 2 | 3 |
| **CO 2** | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 3 | 3 |
| **CO 3** | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | 1 | 2 | 3 | 3 |
| **CO 4** | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | 1 | 2 | 3 | 3 |
| **CO 5** | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | 1 | 2 | 3 | 3 |

**UNIT - I**

**The Machine Learning Landscape:** What Is Machine Learning, Why Use Machine Learning, Examples of Applications, *Types of Machine Learning Systems:* Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, *Main Challenges of Machine Learning:* Insufficient Quantity of Training Data, Non representative Training Data, Poor-Quality Data, Irrelevant Features, Overfitting the Training Data, Under fitting the Training Data, Stepping Back, *Testing and Validation:* Hyper parameters Tuning and Model Selection , Data Mismatch.

**UNIT - II**

**Classification:** Training a Classifier, *Performance Measures:* Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Trade-off, the ROC Curve, Multiclass Classification. **Decision Trees:** Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy? Regularization Hyper parameters, Regression, Instability.

**UNIT - III**

**Support Vector Machines:** Linear SVM Classification, Soft Margin Classification, *Nonlinear SVM Classification:* Polynomial Kernel, Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, *Under the Hood:* Decision Function and Predictions, Training Objective, Kernelized SVMs. **Bayes Classification:** Maximum Posteriori, Bayes Belief Networks.

**UNIT - IV**

**Regression:** *Linear Regression*: The Normal Equation, Computational Complexity, *Gradient Descent:* Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent, Polynomial Regression, Learning Curves, *Regularized Linear Models:* Ridge Regression, Lasso Regression, Elastic Net, Early Stopping, *Logistic Regression:* Estimating Probabilities, Training and Cost Function, Decision Boundaries, Softmax Regression.

**UNIT - V**

**Dimensionality Reduction**: The Curse of Dimensionality, PCA, Randomized PCA, Incremental PCA, Kernel PCA, LLE. **Unsupervised Learning Techniques:** *Clustering:* K-Means, Limits of K-Means, Using Clustering for Image Segmentation, DBSCAN, Other Clustering Algorithms, Gaussian Mixtures. **Ensemble Learning and Random Forests:** Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting.

**Text Books:**

1. Aurelien Geron, “Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow”- Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd edition, O’Reilly,2019

**Suggested Reading:**

1. Tom Mitchel, “Machine Learning”, Tata McGraW Hill, 2017.
2. Stephen Marshland, “Machine Learning: An Algorithmic Perspective”, CRC Press Taylor & Francis, 2nd Edition, 2015

**Web Resources:**

1. https://www.coursera.org/specializations/machine-learning

**22MBC01**

# ENGINEERING ECONOMICS AND ACCOUNTANCY

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of Semester End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

## Course Objectives:

This course aims to:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

## Course Outcomes:

Upon completion of this Course, student will be able to:

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | **-** | **-** | **-** |
| **CO 2** | 2 | 2 | 2 | 2 | - | 1 | 1 | 1 | - | 1 | - | 1 | **1** | **-** | **1** |
| **CO 3** | 1 | 2 | 1 | 2 | 2 | - | 2 | 1 | - | 1 | - | - | **-** | **-** | **1** |
| **CO 4** | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 3 | - | 1 | - | - | **-** | **-** | **1** |
| **CO 5** | 1 | 3 | 1 | 2 | 1 | 1 | 2 | - | - | 1 | 2 | 1 | **-** | **-** | **1** |

**UNIT - I**

**Introduction to Managerial Economics:** Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

**UNIT - II**

**Demand and Supply Analysis:** Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

**UNIT - III**

**Production and Cost Analysis:** Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features of Perfect Competition, Price Output Determination under Perfect Competition, Features of Monopoly Competition, Price Output Determination under Monopoly Competition Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

**Unit - IV**

**Accountancy:** Book-keeping, Principles and Significance of Double Entry Bookkeeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

**Unit - V Capital and Capital Budgeting:** Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

**Text Books:**

1. Mehta P.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 12th Edition, 2018.

## Suggested Readings:

1. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2016.
2. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
3. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
4. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2018.

**22CEM01**

## ENVIRONMENTAL SCIENCE (MANDATORY COURSE)

| | |
|---|---|
| Instruction | 2 L Hours per week |
| Duration of SEE | 2 Hours |
| SEE | 50 Marks |
| CIE | 0 Marks |
| Credits | 0 |

**Course Objectives:**

The objectives of the course is to make the student

1. To equip the students with inputs on the environment, natural resources and their conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems. To understand the importance of biodiversity and create awareness on its threats and conservation strategies.
3. To enable the students become aware of pollution of various environmental segments including their causes, effects, and control measures. To create awareness about environmental legislations in the context of national conventions.

**Course Outcomes:**

At the end of the course, student is able to

1. Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and effects of over utilisation.
2. Understand the concept of ecosystems and realise the importance of interlinking of food chains.
3. Contribute for the conservation of bio-diversity.
4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

### Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | - | - | - | - | - | 3 | - | - | - | - | 1 | - | - | - |
| **CO 2** | 1 | - | - | - | - | - | 2 | 1 | - | - | - | 1 | - | - | - |
| **CO 3** | 1 | - | - | - | - | - | 2 | 1 | - | - | - | 1 | - | - | - |
| **CO 4** | 1 | - | - | - | - | 1 | 2 | 1 | - | - | - | 1 | - | - | - |
| **CO 5** | 1 | - | - | - | - | 1 | 2 | 1 | - | - | - | 1 | - | - | - |

**UNIT- I:**

**Environmental Studies:** Definition, Scope and importance, need for public awareness.

**Natural resources:** Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

**UNIT – II:**

**Ecosystems:** Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

**UNIT – III:**

**Biodiversity:** Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

**UNIT – IV:**

**Environmental Pollution:** Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

**Environmental Legislations:** Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

**UNIT – V:**

**Social issues and the environment:** Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

**Text Books:**

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria& Sons, 2009.

**Suggested Reading:**

1. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006

**22ITE02**

# DIGITAL IMAGE PROCESSING

**(Professional Elective – I)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:**

1. To introduce the fundamental concepts and applications of digital image processing.
2. To impart knowledge on the image processing concepts: intensity transformations, spatial filtering, Smoothing and sharpening both in spatial and frequency domain.
3. To familiarize the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.
4. To introduce colour image processing techniques.
5. To understand with various image compression methods.

**Course Outcomes:**

On Successful completion of this course, student will be able to:

1. Illuminate the fundamental concepts and applications of digital image processing techniques.
2. Demonstrate intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration concepts.
3. Demonstrate image restoration and morphological image processing methods.
4. Apply object recognition techniques by using image segmentation and image representation & description methods.
5. Illustrate the various colour models and Application of image compression methods.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 1 | 1 | 1 | 1 | - | 1 | - | - | - | - | 1 | 1 | 1 | 2 |
| **CO 2** | 2 | 2 | 2 | 1 | - | 2 | 1 | - | - | 1 | - | 1 | 1 | 2 | 2 |
| **CO 3** | 2 | 2 | 2 | 1 | - | 2 | 1 | - | - | 1 | - | 1 | 1 | 2 | 2 |
| **CO 4** | 2 | 1 | 1 | 2 | 1 | - | 1 | - | - | - | - | 1 | 1 | 2 | 2 |
| **CO 5** | 2 | 2 | 2 | 1 | - | 2 | 1 | - | - | 1 | - | 1 | 1 | 2 | 2 |

**UNIT-I**

**Introduction:** Fundamental Steps in Digital Image Processing, Image Sampling and Quantization, Some Basic Relationships between Pixels; **Intensity Transformations:** Some Basic Intensity Transformation Functions, Histogram Processing - Histogram Equalization, Histogram Matching (Specification)

**UNIT-II**

**Spatial Filtering**: Fundamentals of Spatial Filtering, Smoothing Spatial Filters; Sharpening Spatial Filters; **Filtering in the Frequency Domain**: The 2-D Discrete Fourier Transform and its inverse; The Basics of Filtering in the Frequency Domain; Image Smoothing Using Frequency Domain Filters - Ideal, Butterworth and Gaussian Low pass Filters; Image Sharpening Using Frequency Domain Filters - Ideal, Butterworth and Gaussian High pass Filters.

**UNIT-III**

**Image Restoration and Reconstruction:** A Model of the Image Degradation/Restoration Process, Noise Models; Restoration in the Presence of Noise Only—Spatial Filtering; Periodic Noise Reduction by Frequency Domain Filtering; Estimating the Degradation Function; Inverse Filtering; Minimum Mean Square Error

(Wiener) Filtering; **Morphological Image Processing**: Preliminaries; Erosion and Dilation; Opening and Closing, The Hit or Miss Transform

**UNIT-IV**

**Image Segmentation:** Fundamentals; Points, Line and Edge Detection, Thresholding; Segmentation by Region Growing, Region Splitting and Merging

**Feature Extraction:** Boundary Pre-processing, Boundary Feature Descriptors, Some Simple Region Descriptors.

**Image Pattern Classification:** Patterns and Pattern Classes, Pattern Classification by Prototype Matching

**UNIT- V**

**Colour Image Processing:** Colour Fundamentals; Colour Models, Pseudo Colour Image Processing, Basics of full Colour Image Processing;

**Image Compression:** Fundamentals, Huffman Coding, Arithmetic Coding, LZW Coding

**Text Book:**

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, 4th Edition, 2020.

**Suggested Reading:**

1. Vipula Singh, ―Digital Image Processing with MatLab and lab View‖, Elsevier.
2. Thomas B. Moeslund, ―Introduction to Video and Image Processing: Building Real Systems and Applications‖, Springer, 2012.
3. Milan Sonka, Vaclav Halvac and Roger Boyle, ―Image Processing, Analysis, and Machine Vision‖, 2nd Edition, Thomson Learning Publishers.
4. Kenneth R.Castleman, ―Digital Image Processing‖, Pearson Education, 2006.

**Web Resource:**

1. www.imageprocessingplace.com
2. https://in.mathworks.com/discovery/digital-image-processing.html
3. https://imagemagick.org/
4. https://nptel.ac.in/courses/117105079/

**22ITE04**

# MOBILE APPLICATION DEVELOPMENT

**(Professional Elective – I)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:**

1. To Introduce the Kotlin Programming Language for Mobile Application Development.
2. To demonstrate the development of basic mobile applications on android operating system.
3. To implement the design using specific mobile development frameworks.
4. To demonstrate the Location based services in mobile application design.
5. To demonstrate their ability to deploy the mobile applications in the marketplace for distribution.

**Course Outcomes:**

On Successful completion of this course, student will be able to:

1. Understand the benefits of using Kotlin for Mobile application development.
2. Design user interface for mobile applications.
3. Use Intent, Broadcast receivers and Internet services in Android App.
4. Use multimedia, camera and Location based services in Android App.
5. Apply best practices to implement databases and publish apps on Playstore.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | - | 2 | 1 | 2 | - | 2 | - | - | - | 1 | - | - | 1 | 2 | 2 |
| **CO 2** | - | 2 | 1 | 2 | - | 2 | - | - | - | - | - | - | 1 | 1 | 1 |
| **CO 3** | - | 2 | 1 | 2 | - | 2 | - | - | - | - | - | - | - | - | 1 |
| **CO 4** | - | 2 | 1 | 2 | - | 2 | - | - | - | - | - | - | 1 | 2 | 2 |
| **CO 5** | - | 2 | 2 | 2 | 3 | 2 | - | - | 3 | - | - | 1 | 1 | 2 | 2 |

**UNIT-I**

Introduction to Kotlin - Basic expressions - Control flow statements - null safety – Functions- passing functions as arguments - simple lambdas. Object oriented programming in Kotlin - Classes and Objects – Constructors - Visibility modifiers - Subclasses and Inheritance – Interfaces - Data classes - Singleton class – Pairs- Triples.

**UNIT-II**

Introduction to Android Architecture: History - Features and Android Architecture – Android SDK Tools - Application Components - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Android Localization.

**UNIT-III**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS. Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

**UNIT-IV**

Camera –Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location.

**UNIT-V**

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases - Deploying Android Application to the World.

**Text Books:**

1. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015.

**Suggested Reading:**

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Wei-Meng Lee, Beginning Android 4 Application Development, 4th Edition, Wiley India (Wrox), 2013.

**Web Resources:**

1. https://developer.android.com
2. http://www.androidcentral.com/apps
3. https://www.opensesame.com/c/android-app-development-beginners-training-course

**22ITC17**

# WEB TECHNOLOGIES
**(Professional Elective – I)**

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 60 Marks |
| Continuous Internal Evaluation | 40 Marks |
| Credits | 3 |

**Course Objectives:**
1. To understand how HTML, CSS, JavaScript and Bootstrap work together.
2. To explore various features of JS and its functionality.
3. To understand the basics of MongoDB and its Data Model.
4. To comprehend the new features of JS, role of React JS in responsive web application development.
5. To familiarize with configuration of NPM and backend integration with NODE JS and Express JS.

**Course Outcomes:**
On successful completion of this course, students will be able to:
1. Create web pages with good aesthetic sense of design using HTML CSS3, Bootstrap and popular themes.
2. Use JS in Validations and DOM manipulation.
3. Design Schema and perform CRUD operations from UI components.
4. Become an agile practitioner with the ability to quickly complete projects using ReactJS.
5. Build an end-to-end application from scratch using React JS, NODE JS, Express JS and Mongo DB.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | 3 | 1 | 1 | - | - | - | 1 | 1 | 1 | 1 | - | - | 1 |
| **CO 2** | 2 | 1 | 2 | 1 | 2 | - | - | - | - | - | 1 | - | - | 1 | 2 |
| **CO 3** | 2 | 1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO 4** | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 1 | 2 | 2 |
| **CO 5** | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 2 | 2 | 2 |

**UNIT-I**
**Introduction:** Web Fundamentals, **HTML 5.0:** basic tags, Images, Tables, Lists, Forms, Layout, Graphics, span and div tags. Grid.
**Introduction to Cascading Style Sheets:** Types of CSS**,** text and font, color**,** CSS Selectors, CSS BOX Model, CSS Positioning, and CSS floating.
**Bootstrap:** Introduction of Bootstrap, Container and Container-fluid, Jumbotron, Grid, Table, Form, Alert, Navbar, Modals.

**UNIT-II**
**Java Script:** Introduction, data types, control structures, functions, arrays, objects, regular expressions, working with events, form validation, DOM Elements, Accessing and modifying Elements using DOM, Dynamic document with Java script.
.

**UNIT-III**
**Mongo DB:** Introduction, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, toArray, pretty, forEach, limit, count, sort, Columnar Databases, Indexing and Aggregation, MongoDB Node JS Drivers and CAP theorem.

**UNIT-IV**
**React Js:** ES5 vs Es6, Scoping - var vs let vs const, Arrow functions, Use of this keyword (lexical scoping),

Spread & rest parameter, Array & object destructure, module import and export, State, Props, Components, Lifecycle, Stateful and stateless components, Events, Router, Forms, Tables, Portals, CSS, Hook and new Features added in recent versions.

**UNIT-V**

**Node JS:** Creating Web Server, Functions, Buffer, Node Modules, Creating Web Server, Handling HTTP requests.

**Express JS:** API methods - GET, POST, PUT, DELETE, Request & response objects, URL and Query parameters, Routing, Templates, middleware and the model-view-controller pattern.

**Text Books:**

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", second Edition, Apress Publications, 2019.
2. David Hows, Peter Membrey, EelcoPlugge – "MongoDB Basics", Apress, 2014.

**Suggested Reading:**

1. Ethan Brown, "Web Development with Node and Express", Oreilly Publishers, First Edition, 2014.
2. Shelly Powers, "Learning Node: Moving to the Server-Side", 2nd Edition, O"REILLY, 2016.
3. Simon D. Holmes and Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Second Edition, Manning Publications, 2019
4. Brad Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley Professional, 2017.

**Web Resources:**

1. https://web.stanford.edu/class/cs142/index.html
2. https://nodejs.org/en/docs/
3. https://www.mongodb.com/
4. https://reactjs.org/
5. https://getbootstrap.com/docs/5.0/utilities/api/
6. https://edu.anarchocopy.org/Programming%20Languages/Node/Pro%20MERN%20Stack,%202nd%20Edition.pdf

**22ADE01**

# DATA ANALYSIS AND VISUALIZATION

**(Professional Elective – I)**

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of Semester End Examination | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Course Objectives:**

This course aims to:

1. Introduce the Numpy library in Python to support storage and operations on large multi-dimensionalarrays and matrices
2. Introduce large collection of mathematical functions to operate on multidimensional sequential data structures
3. Demonstrate the functionality of the Pandas library in Python for open source data analysis and manipulation
4. Demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas
5. Introduce the Matplotlib library in Python for resting static, animated and interactive visualizations

**Course Outcomes:**

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

1. Use Numpy library utilities for various numerical operations.
2. Apply pandas library functions for handling data frames.
3. Perform various preprocessing operations on datasets using Pandas Series and DataFrame objects.
4. Analyze the given dataset and derive conclusions using inferential statistics.
5. Apply 2-D and 3-D plotting techniques on datasets using matplotlib and seaborn

**Mapping of Course Outcomes with program Outcomes and Program Specific Outcomes:**

| PO/PSO CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | 2 |
| **CO2** | 3 | 2 | - | 1 | 1 | - | - | - | - | - | - | 3 | - | - | 2 |
| **CO3** | 3 | 1 | - | 3 | 1 | - | - | - | - | 1 | - | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 1 | 3 | 1 | - | - | - | - | 3 | - | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 2 | - | 2 | 1 | - | - | - | - | 3 | - | 3 | 2 | - | 2 |

**UNIT - I**

**Introduction to Numpy:** Data types in Python - Fixed type arrays, creating arrays, array indexing, array slicing, reshaping arrays, array concatenation and splitting, Universal Functions, Aggregations, Broadcasting rules, Comparisons, Boolean Arrays, Masks Fancy Indexing, Fast Sorting using np.sort and np.argsort, partial sorting Creating Structured Arrays, Compound types and Record Arrays.

**UNIT - II**

**Introduction to Pandas:** Series Object, DataFrame Object, Data Indexing and Selecting for Series and DataFrames,Universal Functions for Index Preservation, Index Alignment and Operations between Series and DataFrames, Handling missing data, operating on Null values, Hierarchical Indexing.

**UNIT - III**

**Combining Datasets:** Concat, Append, Merge and Joins, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance functions - query() and eval()

**UNIT - IV**

**Inferential Statistics** - Normal distribution, Poisson distribution, Bernoulli distribution, z-score, p-score, One-tailed and two-tailed, Type 1 and Type-2 errors, Confidence interval, Correlation, Z-test vs T-test, F- distribution, Chi-square distribution, the chi-square test of independence, ANOVA, data mining, titanic survivors dataset analysis

**UNIT - V**

**Visualization with Matplotlib :** Simple Line plots, Scatter plots, Visualizing errors, Density and Contour plots, Histograms, Binnings, Multiple subplots, Three-dimensional plotting with Matplotlib, Geographic data with Basemap, Visualization with Seaborn.

**Text Books:**

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 2016.
2. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

**Web Resources:**

1. https://www.coursera.org/learn/python-data-analysis?specialization=data-science-python
2. https://www.coursera.org/learn/python-plotting

**22ADE02**

# DATA WAREHOUSING AND DATA MINING

**(Professional Elective - I)**

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of Semester End Examination | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Course Objectives:**

This course aims to:

1. To introduce the concepts of Data Warehouse and Data Mining.
2. To familiarize different kinds of data and various preprocessing techniques.
3. To study different frequent pattern discovery methods.
4. To learn various classification and clustering techniques.
5. To introduce the concept of outlier analysis.

**Course Outcomes:**

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

1. Understand the concepts and issues of data mining, apply preprocessing techniques.
2. Build multidimensional data model and perform OLAP operations, generate association rules.
3. Evaluate various models for classification and prediction.
4. Analyze advanced classification methods and clustering techniques.
5. Understand outlier detection and real time applications of data mining.

**Mapping of Course Outcomes with program Outcomes and Program Specific Outcomes:**

| PO/PSO CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 3 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 3 | 2 |
| **CO2** | 2 | 1 | 2 | 2 | - | - | - | - | - | 1 | - | 1 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | - | 1 | - | - | - | 1 | 1 | 3 | 3 | 2 |
| **CO4** | 2 | 3 | 2 | 3 | 2 | - | 1 | - | - | - | 1 | 1 | 3 | 3 | 2 |
| **CO5** | 2 | 1 | 1 | 2 | 1 | - | 1 | - | - | - | 1 | 1 | 1 | 3 | 2 |

**UNIT - I**

**Introduction:** Data mining, Kinds of data, Kinds of pattern, Major issues in data mining. Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. **Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

**UNIT - II**

**Data Warehousing and Online Analytical Processing:** Data Warehouse - Basic Concepts, Data Warehouse Modeling - Data Cube and OLAP, **Data Warehouse Design and Usage:** A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, and Data Warehouse Usage for Information Processing. **Mining Frequent Patterns, Associations and correlations:** Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods. **Advanced Pattern Mining:** Pattern Mining in Multilevel and Multidimensional Space.

**UNIT - III**

**Classification:** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, **Techniques to Improve Classification Accuracy:** Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class Imbalanced Data.

**UNIT - IV**

**Classification:** Advanced Methods: Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods. Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering, Clustering graph and network data.

**UNIT - V**

**Outlier Detection:** Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, ProximityBased Approaches. Data Mining Trends and Research Frontiers: Mining Complex Data Types: Mining Sequence Data: Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

**Text Book:**

1. Han J, Kamber M, Jian P, “Data Mining: Concepts and Techniques”, 3rd Edition, Elsevier, 2012.

**Suggested Reading:**

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy, “Data Warehousing: Architecture and Implementation”, Pearson Education, 2009.
3. Anahory, Murray, “Data Warehousing in the Real World”, Pearson Education, 2008.
4. Kargupta, Joshi, et al, “Data Mining: Next Generation Challenges and Future Directions”, Prentice Hall of India Pvt. Ltd, 2007.

**Web Resources:**

1. https://hanj.cs.illinois.edu/bk3/
2. https://www.kdnuggets.com/
3. http://archive.ics.uci.edu/ml/index.php

**22MTC17**

## STOCHASTIC PROCESS AND QUEUEING THEORY LAB

| | |
|---|---|
| Instruction | 2 P Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Course Objectives**:
1. Able to learn methods to solve problems related probability functions.
2. Able to know characterizing a random phenomenon.
3. Able to identify the tools for interpreting the bivariate data
4. Able to know the statistical techniques to study random process
5. Able to analyze the queueing models

**Course Outcomes:**
On successful completion of this course the students will be able to
1. Interpret the plots of statistical averages
2. Compute the measures of variation for stochastic data
3. Characterize the bivariate probability distribution of averages
4. Analyze the probabilities using probability functions.
5. Analyze the queuing behavior of different queuing models.

### Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 2** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 3** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 4** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| **CO 5** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 | 2 |

### List of Experiments

1. Write a Program to create Graphs and Charts
2. Write a Program to calculate measures of Central Tendency for the data
3. Write a Program to compute Measures of Dispersion for the data
4. Write a Program for Correlation and Covariance using Pearson method
5. Write a Program for calculating Marginal functions for Bivariate Probability Distribution
6. Write a program for calculating Conditional Probability function for Bivariate Probability Distribution
7. Write a Program to compute Probabilities using Poisson Distribution
8. Write a Program to compute probabilities using Normal Distribution
9. Write a program to compute probabilities using Exponential Distribution
10. Write a Program for plotting Bivariate Gaussian Function
11. Write a Program for Creating a Queueing Model

**Text Books:**
1. S.R.Mani Sekhar, Dr. T.V. Suresh Kumar, “Programming with R” CENGAGE Publishers, 2017.
2. K.G.Srinivasa, G.M.Siddesh, “Statistical Programming in R”, Oxford University Press, 2017.
3. Jared P Lander, “R for Everyone” Pearson.2018.
4. **http://www.cyclismo.org/tutorial/R/**

**22CSC34**

# DESIGN AND ANALYSIS OF ALGORITHMS LAB

| | |
|---|---|
| Instruction | 2 P Hours per week |
| Duration of End Examination | 3 Hours |
| Semester End Examination | 50 Marks |
| Continuous Internal Evaluation | 50 Marks |
| Credits | 1 |

**Pre-requisites:** Programming and Problem Solving, Basics of Data structures and algorithms lab and Object Oriented Programming.

## Course Objectives:

This course aims to:

1. Design and construct simple programs by using the different design strategies for solving different problems.
2. To enhance programming skills while improving their practical knowledge in implementing the algorithms.
3. To strengthen the practical ability and to apply suitable algorithmic approaches for solving real time problems.

## Course Outcomes:

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

1. Implement greedy, dynamic programming, backtracking and branch and bound techniques.
2. Demonstrate various algorithmic design techniques.
3. Analyze the performance of various algorithms.
4. Compare various design strategies.
5. Formulate solutions to solve real world problems use acquired knowledge.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 1 | 1 | 2 | 1 | - | - | - | - | 1 | - | 1 | 2 | 2 |
| **CO 2** | 3 | 2 | - | 1 | 1 | 1 | - | - | 1 | - | 2 | - | 1 | 2 | 3 |
| **CO 3** | 3 | 3 | 2 | 2 | 1 | 2 | - | - | 1 | - | 1 | - | 1 | 2 | 3 |
| **CO 4** | 3 | 1 | 1 | 2 | - | 1 | - | - | - | - | 1 | - | 1 | 2 | 3 |
| **CO 5** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | - | 2 | - | 1 | 2 | 3 |

## The following task should be carried out by the students in the laboratory for each experiment:

1. Setup the environment for the experiment.
2. Select appropriate design technique to implement the problem.
3. Represent the solution using algorithm
4. Analyze the performance of the algorithm (Time and Space complexity)
5. Justify the performance of your solution is better than other strategies.

## List of Experiments:

1. You are given the task of choosing the optimal path to connect ‘N’ devices. The devices are connected with the minimum required N-1 wires into a tree structure, and each device is connected with the other with a wire of length ‘L’ i.e ‘$D_1$’connected to ‘$D_2$’ with a wire of length ‘$L_1$’. This information will be available for all ‘N’ devices.
   a. Determine the minimum length of the wire which consists of N-1 wires that will connect alldevices.
   b. Determine the minimum length of the wire which connects $D_i$ to all other devices where$1 \leq i \leq N$.
2. CSE department of CBIT want to generate a time table for ‘N’ subjects. The following information is given-subject name, subject code and list of subjects code which clashes with this subject. The problem is to

identify the list of subjects which can be scheduled on the same time line such that clashes among them do not exist.

3. A Test has 'N' questions with a heterogeneous distribution of points. The test-taker has a choice as to which questions can be answered. Each question $Q_i$ has points $P_i$ and time $T_i$ to answer the question, where $1 \leq i \leq N$. The students are asked to answer the possible subsets of problems whose total point values add up to a maximum score within the time limit 'T'. Determine which subset of questions gives student the highest possible score.
4. Given N items with their corresponding weights and values, and a package of capacity C, choose either the entire item or fractional part of the item among these N unique items to fill the package such that the package has maximum value.
5. Given a bunch of projects, where every project has a deadline and associated profit if the project is finished before the deadline. It is also given that every project takes one month duration, so the minimum possible deadline for any project is 1 month. In what way the total profits can be maximized if only one project can be scheduled at a time.
6. N-Queen is the problem of placing 'N' chess queens on an N×N chessboard. Design a solution for this problem so that no two queens attack each other.

   **Note: A queen can attack when an opponent is on the same row, column or diagonal.**
7. Bi-connected graphs are used in the design of power grid networks. Consider the nodes as cities and the edges as electrical connections between them, you would like the network to be robust and a failure at one city should not result in a loss of power in other cities.

**Text Books:**

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press/McGraw-Hill, 2009.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Second Edition, Wiley, 2001.

**22ADC02**

# MACHINE LEARNING LAB

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of SEE | 3 Hours |
| CIE | 50 Marks |
| SEE | 50 Marks |
| Credits | 1.5 |

**Course Objectives:**

This course aims to:

1. To impart knowledge of dimensionality reduction and clustering techniques.
2. To introduce the concept of decision tree for supervised learning.
3. To familiarize with Bayesian decision theory and probabilistic methods.
4. To introduce the concept of SVM.
5. To familiarize with ensemble methods.

**Course Outcomes:**

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

1. Perform dimensionality reduction of a dataset.
2. Build decision trees for classification.
3. Design solutions using SVM, KNN, Regression algorithms.
4. Perform clustering of data.
5. Use principle Component Analysis for feature Extraction.

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 3 |
| **CO 2** | 1 | 1 | - | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 3** | 2 | 1 | 1 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 4** | 1 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO 5** | 2 | 1 | - | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 |

**LIST OF PROGRAMS:**

1. Vectors, Matrices, and Arrays representation, Loading of different types of data
2. Data Wrangling, Handling Numerical, Categorical and Image Data
3. Data Reduction Using Feature Extraction, Feature Selection, PCA
4. Linear Regression, Nonlinear Regression, Ridge Regression, Esso Regression, Logistic Regression
5. Decision Trees and Random Forest
6. K-Nearest Neighbor Classifiers with different similarity Measures
7. Support Vector Machines for Classification and Regression
8. Naive Bayes classifier for continuous and discrete datasets
9. Clustering using K-Means, DBSCAN
10. Model Selection, Saving and Loading Trained Models.

**Text Books:**

1. Aurelien Geron, “Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow”, O’Reilly Media, 2nd Edition, 2019.
2. Chris Albon, “Python Machine Learning Cook Book”. Orielly, Ist Edition, 2018

**Suggested Reading**:

1. Tom Mitchel, "Machine Learning", Tata McGraW Hill, 2017.
2. Stephen Marshland, "Machine Learning: An Algorithmic Perspective", CRC Press Taylor & Francis, 2nd Edition, 2015

**Datasets:**

1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007

**Web Resource:**

1. https://www.coursera.org/specializations/machine-learning

**22ADC04**

# LINUX AND LATEX LAB

| | |
|---|---|
| Instruction | 3 L Hours per week |
| Duration of SEE | 3 Hours |
| CIE | 50 Marks |
| SEE | 50 Marks |
| Credits | 1 |

**Course Objectives:**
This course aims to:
1. Understand the purpose and nature of LaTeX, user interface of LaTeX
2. Understand how LaTeX differs from a word processor, format text in various ways
3. Learn how to use LaTeX to format mathematical equations.
4. Recognize, understand, and make use of various UNIX commands
5. Gain hands on experience of UNIX commands and shell programs.

**Course Outcomes:**
Upon successful completion of the course the students will be able to:
1. Run various UNIX commands on a standard UNIX/LINUX Operating system
2. Understand the shell programming on UNIX OS
3. Typing of text including roman letters, alphabets, special symbols and mathematical symbols in LaTeX.
4. Display of equations in LaTeX.
5. Creating a table and drawing a figure in LateX

## Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

| PO/PSO / CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | - | - | - | 2 | 1 | - | - | - | - | - | - | - | - | - |
| **CO 2** | 3 | - | - | - | 2 | 1 | - | - | - | - | - | - | - | - | - |
| **CO 3** | 3 | - | - | - | 3 | 1 | - | - | - | - | - | - | - | 1 | - |
| **CO 4** | 3 | - | - | - | 3 | 1 | - | - | - | - | - | - | - | - | 1 |
| **CO 5** | 3 | - | - | - | 3 | 1 | - | - | - | - | - | - | - | - | 1 |

**LIST OF PROGRAMS:**

1. Use of basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
2. Commands related to inode, I/O redirection, piping, process control commands, mails.
3. Shell Programming: shell script exercise based on following:
   a. Interactive shell script
   b. Positional parameters
   c. Arithmetic
   d. If-then-fi, if-then-else-fi, nested if-else
   e. Logical operators
   f. Else + if equals elif, case structure
   g. While, for loop
   h. Meta characters
4. Write a shell script to change date format. Show the time taken in execution of this script
5. Write a shell script to count lines, words & characters in its input. (do not use wc)
6. Introduction and basics of LaTeX.
7. Document structure and text formatting in LaTeX.

8. To Create Special Pages: Indexing, Glossary, Bibliography
9. To Create Special Documents: Letters, Presentations, Curriculum Vitae.
10. Creating Graphics in LaTeX.
11. Programming: Macros, Plain text, Creating Packages, Themes.
12. Miscellaneous: Modular Documents, Collaborative Writing of LaTeX Documents, Export to other Formats.

**Text Books:**

1. Behrouz A. Forouzan, Richard F. Gilberg,"Unix and shell Programming.", Cengage Learning.
2. Lamport, Leslie (1994). LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Pearson Education. Indian Reprint.