



Thursday, the 15th August, 2024

NOTIFICATION

No. 96 /2024

Dated : 15/08/2024

Subject : Implementation of new syllabus of Semester V & VI of B.E. (Computer Science & Engineering) (Data Science) (C.B.C.S.).

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of Semester V & VI of B.E. (Computer Science & Engineering) (Data Science) as per C.B.C.S. pattern to be implemented from the academic session 2024-2025 onwards as mentioned below.

Sd/-
(Dr.A.M.Asanare)
Registrar
Sant Gadge Baba Amravati University

Syllabus of Semester V & VI of B.E. (Computer Science & Engineering) (Data Science) (C.B.C.S.)

SEMESTER V

5KD01/5KS01 DATABASE MANAGEMENT SYSTEMS

Course Prerequisite:

Discrete Mathematics, Data Structures and Algorithm

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):

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

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design&develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS: (Hours: 08)

Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features.

Unit II: Relational Algebra, SQL: (Hours: 07)

Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design: (Hours: 06)

Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs, atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization: (Hours: 08)

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation (Nested Loop & Block Nested Loop Join), Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management: (Hours: 06)

Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements.

Unit VI: Concurrency Control and recovery system: (Hours: 07)

Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system: Failure classification, Storage, Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of non-volatile storage, early lock release and logical undo operations, , Remote Backup Systems

Text Book:

Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, McGraw Hill

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

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SKD02 BUSINESS INTELLIGENCE & ANALYTICS

Course objectives:

- Explain the Business Intelligence, Analytics and Decision Support system.
- List the technologies for Decision making, Automated decision systems
- Explain sentiment analysis techniques.
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

Course Outcomes (Expected Outcome):

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

1. Understand the principles and benefits of Business Intelligence (BI) and Analytics.
2. Master the Knowledge Discovery in Databases (KDD) process and data pre-processing techniques.
3. Recognize the phases and capabilities of Decision Support Systems (DSS) in data-driven decision-making.
4. Comprehend Data Warehousing concepts, including architecture and data integration techniques.
5. Apply Data Mining techniques for association analysis and frequent item set identification.
6. Develop proficiency in Data Visualization using tools like Tableau and Power BI for effective data communication.

SYLLABUS

Unit I: Introduction to Business Intelligence (Hours: 07)

A Framework for Business Intelligence, Business Analytics Overview Business Intelligence, architecture, Use and benefits of Business Intelligence. Best practices and challenges in BI implementation, Overview of Business Intelligence (BI) and Analytics , Importance and benefits of BI in business decision-making

Unit II: Knowledge Discovery Database (KDD) (Hours: 07)

Knowledge Discovery in Databases: KDD process model, Data Pre-processing: Cleaning: Missing Values; Noisy Values; Inconsistent values; redundant values. Outliers, Integration, transformation, reduction, Discretization: Equal Width Binning; Equal Depth Binning, Normalization, Smoothing.

Unit III: Introduction to Decision Making (Hours: 07)

Introduction to data-driven decision-making, Introduction and Definitions, Phases of the Decision, Making Process, , Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components. Information Systems Support for Decision Making, The Concept of Decision Support Systems, Operational and Decision Support System.

Unit IV: Introduction to Business Data Warehouse (Hours: 07)

Definition of Data warehouse, Logical architecture of Data Warehouse, Data Warehouse model- Enterprise warehouse; Data Marts; Virtual warehouse. Populating business Data Warehousing: data integration and extract, transform, load (ETL).

Unit V: Introduction to Data Mining Data mining definitions and process (Hours: 07)

Business and data understanding. Association Analysis: Definition of association rule, General issues: Support; Confidence; Lift; Conviction, Frequent Item sets: APriori Algorithm; Issues with APriori Algorithm, Data structures: Hash tree and FP tree.

Unit VI: Data Visualization (Hours: 07)

Importance of data visualization, Principles of effective data visualization, Tools for data visualization, Reports and dashboard designing (e.g., Tableau, Power BI)

Text books:

1. Business Intelligence (2nd Edition), Efraim Turban, Ramesh Sharda, Dursun Delen, David King, Pearson (2013)
2. Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013
3. Business Intelligence for Dummies, Swain Scheps, Wiley Publications (2008).

References:

1. Building the Data Warehouse, Inmon: Wiley (1993).
2. Data Mining: Introductory and Advanced Topics, Dunham, Margaret H, Prentice Hall (2006)
3. Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Witten, Ian and Eibe Frank, Morgan Kaufmann (2011)
4. "Business Intelligence Guidebook: From Data Integration to Analytics" by Rick Sherman
5. "Business Analytics: Data Analysis & Decision Making" by Christian Albright and Wayne Winston
6. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett
7. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Mize.
8. Business Intelligence Road Map, Larissa T. Moss, Shaku Atr, Addison-Wesley
9. Data Modeling Techniques for Data Warehousing by IBM; International Technical Support Organization, Chuck Ballard, Dirk Herreman, Don Schau, Rhonda Bell, Eunsang Kim, Ann Valencic : <http://www.redbooks.ibm.com>
10. Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems, Han J. and Kamber M. Morgan Kaufmann Publishers, (2000).

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SKD03 / SKS03 COMPUTER ARCHITECTURE & ORGANIZATION

Course Pre-requisite:

Microprocessor & Assembly Language Programming

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:

- To discuss the basic concepts and structure of computers.
- To solve concepts of arithmetic operations.
- To understand addressing modes and memory organization.
- To analyze conceptualize multitasking ability of a computer and pipelining
- To explain IO communication

Course Outcomes (Expected Outcome):

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

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

SYLLABUS

Unit I: Basic Structure of Computer: (Hours: 07)

Bus structures, Addressing Methods, and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes, Basic I/O Operations.

Unit II: Memory Unit: (Hours: 07)

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit: (Hours: 07)

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization: (Hours: 07)

Accessing I/O Devices, Interrupts, Enabling and Disabling Interrupts, Handling Multiple Devices, DMA, I/O Hardware, Standard I/O Interfaces: SCSI.

Unit V: Arithmetic: (Hours: 07)

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers, Booth Multiplier, Fast Multiplication, Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining: (Hours: 07)

Parallel Processing, Array Processors, The Structure of General-Purpose Multiple Processors, Symmetric, Multiprocessors, Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text Book:

Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
2. John P. Hayes, “Computer Architecture and Organization”, McGraw Hill Publication.
3. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
4. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

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5KD04 P.E.I: DATA STORAGE & NETWORKS

Course Prerequisite: Storage System, Networking Basics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Storage & Networks by being able to do each of the following:

- To gain basics of SAN and its development.
- To learn storage architecture and its connectivity.
- To understand NAS architecture, its Hardware and Software.
- To learn Storage security methods
- To understand integration of NAS and SAN.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe concept of storage networking
2. Discuss fundamentals of Storage
3. Explain NAS architecture.
4. Compare NAS and SAN architecture.
5. Investigate NAS and SAN technique on stored data.
6. Apply Storage security technology to solve real time challenges.

SYLLABUS

Unit I: Concept of Storage Networking (Hours: 07)

Data Storage and Data Access Problem, Why storage networking, Business application for storage, Benefits of Storage Networks on Business Applications, Effects of Storage networks on IT Organizations, NAS Idea, Evolution and Development, Data-Centric World, Distributing Computer and I/O processing, SAN Evolution and Development.

Unit II: Storage Fundamentals(Hours: 07)

Storage Architectures, Device Overview, Connectivity Options: Connections, Bus Evolution, Bus operations, Bus and Network Architectures, Fibre and I/O Buses, Data Organizational Methods: Organizing data, File Systems and its types.

Unit III: Network Attached Storage(Hours: 07)

NAS Architecture: Hardware and Software Architecture, Network Connectivity, NAS as a Storage, NAS Hardware Devices, NAS Software Components, NAS Connectivity Options.

Unit IV: Storage Area Networks (Hours: 07)

Creating a Network for Storage, Hardware devices, Software Components, Configuration Options for SANs.

Unit V: Application(Hours: 07)

Defining the I/O Workload: Storage Planning and Capacity Planning, Workload attributes, I/O Content and Workloads, Considerations for I/O Workloads in Storage Networking, Applying the SAN to OLTP Workloads, Applying the SAN to Data Warehouse Workloads, Applying the NAS Solution: Applying the NAS to Departmental, Enterprise Web, and Specialized Workloads. Storage Integration, Future Storage Connectivity.

Unit VI: Management and Security(Hours: 07)

Defining the Environment, Role of Storage Networking in Business Continuity, Storage Design and Implementation of the Business, Availability Metrics, Implementing Plan, Overview of Information Security, Security Methods, Challenges, Technology, Fibre Channel and NAS Security.

Text Book: Robert Spadling: Storage Networks: The Complete Reference, McGraw Hill Education, Edition 2003.

Reference Books:

1. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne. 2001.
2. G. Somasundaram, Alok Shrivastava, “Information Storage and Management”, EMC Education Series, Wiley Publishing Inc., 2011.
3. Meeta Gupta, “Storage Area Network Fundamentals”, Pearson Education Limited, 2002
4. Mauricio Arregoces, “Data Center Fundamentals”, Cisco Press, 1st edition, 2003.

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5KD04 P.E.-I: DATA SCIENCE AND STATISTICS

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

1. To understand the need of data science and Statistics
2. To understand the knowledge of statistics data analysis techniques utilized in business decision making.
3. To understand and apply the different data modeling strategies.
4. To apply the learned concept for skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Explain basics and need of data science
2. Describe proficiency with statistical analysis of data.
3. Demonstrate loading of data and its manipulation for data science
4. Perform linear and multiple linear regression analysis.
5. Develop the ability to build and assess classification-based models
6. Evaluate outcomes and make decisions based on data.

SYLLABUS

Unit I: Introduction to Data Science: (Hours: 06)

Data Science: What Is Data Science? Where Do We See Data Science? How Does Data Science Relate to Other Fields? The Relationship between Data Science and Information Science, Computational Thinking , Skills for Data Science , Tools for Data Science, Issues of Ethics, Bias, and Privacy in Data Science Data: Data types, Data Collection, Data Pre-processing.

Unit II: Statistical Learning & Inference (Hours: 08)

Need of Statistics in Data Science, Measures of central tendency: Mean, Median, Mode,. Measures of Dispersion: Range, variance, standard deviation. Techniques: Introduction, Data Analysis and Data Analytics, Descriptive Analysis , Diagnostic Analytics , Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis, Regression

Unit III: Regression and its Techniques (Hours: 06)

Linear Regression, Multiple Linear Regression, Other Considerations in the Regression Model Comparison of Linear Regression with K-Nearest Neighbors

Unit IV: Classification (Hours: 08)

An Overview of Classification, Why Not Linear Regression? Logistic Regression, Support Vector Machine (SVM): Maximal Margin Classifier , Support Vector Classifier

Unit V: Tree Based Methods (Hours: 06)

Tree-Based Methods: The Basics of Decision Trees, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI: Unsupervised Learning (Hours: 06)

Unsupervised Learning: Introduction, Agglomerative Clustering, Divisive Clustering, Expectation Maximization (EM) Introduction to Reinforcement Learning.

Text Books:

1. Chirag Shah, "A Hands-on Introduction to Data Science ", Cambridge University Press (2020) ISBN:978-1-108-47244-9.
2. Data Mining: Concepts and Techniques By Jiawei Han, Jian Pei, Micheline Kamber (Chapter 2: point 2.2)
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in Python , 978-3-031-38747-0 Published: 30 June 2023

Reference Books:

1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN:978-1-449-35865-5.
2. DT Editorial Services, "Big Data, Black Book", DT Editorial Services, ISBN: 9789351197577, 2016 Edition

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5KD04 P.E.-I: CYBER SECURITY

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Introduction to Cyber Security by being able to do each of the following:

- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome):

After completion of this course, the students should be able to:

1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

SYLLABUS

Unit I: Introduction to Cybercrime (Hours: 07)

Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: Cyber offenses (Hours: 07)

Introduction, Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: Cybercrime (Hours: 07)

Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: Tools and Methods Used in Cybercrime (Hours: 07)

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: Access Control and Authorization (Hours: 07)

Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization. Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentications, Authentication Methods.

Unit VI: System Intrusion Detection and Prevention (Hours: 07)

Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools.

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2013
2. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer 2009.

Reference Books:

1. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
2. Nina Godbole, "Information Systems Security", Wiley India, New Delhi
3. Kenneth J. Knapp, "Cyber Security & Global Information Assurance", Information Science Publishing.
4. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials" CRC Press.
5. Jeetendra Pande, "Introduction to Cyber Security" Uttarakhand Open University, 2017

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5KD05/5KS05 O.E. I - DATA STRUCTURE AND ALGORITHM

Course Prerequisite: Basic knowledge of computer programming

Course Objectives:

- To understand the Data Structures and its memory representations
- To perform different operations on Data Structures such as insertion, deletion, searching and traversing.
- To understand various data searching and sorting methods with its complexity.
- To introduce various sorting and searching techniques for representation of the data in the real world.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe basics of Data Structures and algorithms.
2. Explain Data Structures array and link list.
3. Illustrate with example stack and queues operations.
4. Examine the binary tree traversal methods.
5. Construct Graph and shortest path algorithm in graph.
6. Inspect various sorting and searching techniques.

SYLLABUS

Unit I: Introduction to algorithms and Data Structures (Hours:06)

Introduction, Algorithms, Asymptotic Notation, Introduction to Data Structures, Types of Data Structures, Data Structure Operations.

Unit II: Arrays (Hours:06)

Introduction, Types of Arrays, Representation of One-Dimensional Array in Memory, Array Traversal, Insertion and Deletion, Sorting and Searching, Representation of Multi-Dimensional Array in memory, Realizing matrices using Two-Dimensional Arrays, Matrix Operations, Linked List: Introduction, Linked List – Basic Concept, Types of Linked List.

Unit III: Stacks (Hours:06)

Introduction to Stacks, Stack Operations, Queues: Introduction, Queues- Basic Concept, Queue Operations, Basics of Circular Queues and Priority Queues.

Unit IV: Trees (Hours:06)

Introduction, basic concept, Binary Tree, Binary Tree Representation, Binary Tree Traversal, Binary Search Tree, Tree Variants.

Unit V: Graphs (Hours:06)

Introduction, Basic Concept, Graph Terminology, Graph Implementation, Shortest Path Algorithm, Graph Traversal.

Unit VI: Sorting and Searching (Hours:06)

Introduction, Sorting Techniques, Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Bucket Sort, Searching Techniques; Linear Search, Binary Search, Hashing.

Text Book: E. Balagurusay, “Data Structures using C”, McGraw Hill Education, 2018.

Reference Books:

1. Seymour Lipschutz, “Data Structures with C”, Schaum’s Outline Series.
2. Forouzan, Gilberg, “Data Structures and algorithms”, CENGAGE Learning.
3. Reema Thareja, “Data Structures using C”, Oxford University Press, 2011.
4. Arpita Gopal, “Magnifying Data Structures”, PHI (EEE), 2010.
5. Ellis Horowitz and Sartaj Sahani, “Fundamentals of Data Structures”, CBS Publications.

5KD05/5KS05 O.E. I – COMPUTATIONAL TECHNOLOGY

Course Pre-requisite: To introduce basic genomic and transcriptomic sequence processing algorithms and concepts and impart skills regarding the use of popular software tools in this area.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:

- To familiarize the students with most basic and useful algorithms for sequence analysis
- To aware the students with basic file formats
- To transform the basic molecular data for interpreting their patterns for various analysis
- To compare genomes of different species, gene finding, and gene regulation.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.
2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

SYLLABUS

Unit I: (Hours:06)

Cellular and Molecular Biology Fundamentals, the structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: (Hours:06)

Sequence Alignments Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequences Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: (Hours:06)

Pairwise Sequence Alignments & Database Searching Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, aligning complete genome sequences.

Unit IV: (Hours:06)

Patterns Profiles and Multiple Alignments Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: (Hours:06)

Revealing Genome Features Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: (Hours:06)

Gene Detection and Genome Annotation Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:

1. Understanding Bioinformatics , Marketa Zvelbil and Jeremy O. Baum, Garland Science Taylor & Francis Group, LLC
2. Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:

1. Bioinformatics Algorithms – Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.
2. Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.
3. Bioinformatics computing, Bergeron, B. P.(2003), Prentice Hall Professional.
4. Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.
5. Bioinformatics for dummies, Claverie, J. M., &Notredame, C. (2011), John Wiley & Sons.
6. Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

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5KS06 DATABASE MANAGEMENT SYSTEMS Lab.

(Practicals using MongoDB, MySQL)

Course Prerequisite:

Basic concept of programming, Basic concepts of data structures

Course Objectives:

- To study the ER model which provides a high-level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model(relational model)for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome):

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

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

List of Experiments:

This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi

Practical 1: To Study a Database Modelling Tool.

Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modelling tool. The following basic features of the modelling should be covered while building the model:

- Logical / Physical Modelling
- Adding an entity / its attribute, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insertthe data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (% ,_ ,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sort the output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform

- Set membership operations
- In, not in
- Some All
- Exists and not exists, Test for emptiness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5. Study and implement aggregation functions.

- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions

- Write at least 2 functions, and demonstrate its use
- Write at least 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)

HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus) A Simple Servlet., HTTP Servlet API Basics. HTML Form Processing in Servlets.

Practical 15: PHP : Develop a simple application to access the database using PHP (Contents beyond Syllabus)

1. Study of Open Source NoSQL Databases
2. Based on the concepts covered in text create a Mini Project:

Suggested Topics:

- Bank database (Given in Korth book)
- University Database (Given in Korth book)
- Airline Flight Information System.
- Library Database Application.
- University Student Database.
- Video Chain Database.
- Banking Database.
- BiBTeX Database.
- Music Store Database.
- Online Auctions Database.
- A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books:

1. Kevin Roebuck, “Storing and Managing Big Data - NoSQL, HADOOP and More”, EmereopyLimited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide” ,O"Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, “NoSQL For Dummies”, John Wiley & Sons, ISBN-1118905628
4. C J Date, “An Introduction to Database Systems”, Addison-Wesley, ISBN: 0201144719.

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5KD07 BUSINESS INTELLIGENCE & ANALYTICS - Lab

Basic list of experiments for learning Tableau:

Getting Started:

- Installation and Setup: Install Tableau Desktop or Tableau Public and get familiar with the interface.
- Connecting to Data: Import sample datasets or connect to a database to practice data importation.

Basic Visualization:

- Creating a Bar Chart: Visualize simple data using a bar chart.
- Line Chart: Create a line chart to represent trends over time.
- Pie Chart: Practice creating a pie chart to display proportions of a whole.
- Interactive Visualizations:

Filters: Use filters to interactively explore data subsets.

Highlighting: Highlight specific data points or categories in your visualizations.

Heat Maps: Create a heat map to visualize data density or intensity.

Scatter Plots: Represent correlations between two variables using scatter plots.

Tree Maps: Use tree maps to display hierarchical data structures.

Dashboard Creation:

Building a Dashboard: Combine multiple visualizations into a dashboard layout.

Dashboard Interactivity: Add interactivity to your dashboard using actions and filters.

Dashboard Formatting: Customize the appearance and layout of your dashboard.

Mapping and Geographic Analysis:

Geographical Data Visualization: Plot data points on a map and customize map layers.

Spatial Analysis: Perform basic spatial analysis such as distance calculations or clustering.

Data Pre-processing basic operation using python

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5KD08 Prof. Elect. Lab# I (EMERGING TECHNOLOGY LAB. I)

5KS08 Emerging Technology Lab 1 is based on 5KS04 Professional Elective-I. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph

DS :R, Python, Cassandra, Apache Hadoop,

IoT : Arduino, DeviceHive, Kaa, Home Assistant

Cyber Security: Kali Linux, OpenVPN, NMAP, Metasploit Framework

5KD09 C-SKILL LAB -III

(Based on technology like - Angular & React, Express, Node.js etc. to be decided by Individual Dept. of respective College)

Course Prerequisite:

Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

- To develop an ability to set up a local JS Library/Framework development Environment.
- To be able to install and implement different JS Libraries and Frameworks
- To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome):

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

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi.

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the "upper-case" package of NPM.
7. To study event handling in Node.js and demonstrate it using event module and Event Emitter object.
8. To study and implement the formidable module of Node.js to upload the file on the server.
9. To study and implement the Node mailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using "INSERT" statement and Node.js
13. To demonstrate the display of records from the MySQL database using "SELECT" statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using "WHERE" statement using Node.js
15. To demonstrate deletion of records from database using "DELETE" statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

18. Create an Email sender app using Node.js
19. Create a Basic User database: Site in which User can Sign up/Login and can see other User's Profile Information.
20. Create a user model covering Registration, Email verification (send an email), login (with remember me, display user details and allow to save/update user details (DOB, Location, Hobbies etc or anything)
21. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, O'Reilly .

Reference Books:

1. ShyamSeshadri: Angular Up and Running, O'Reilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, O'Reilly

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SEMESTER VI
6KD01 SQL & VISUALIZATION

Course Prerequisite:

Discrete Mathematics, Data Structures and Algorithm

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):

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

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS: (Hours 8)

Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features.

Unit II: Relational Algebra, SQL: (Hours 8)

Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design: (Hours 8)

Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs, atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization: (Hours 8)

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation (Nested Loop & Block Nested Loop Join), Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management: (Hours 8)

Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements.

Unit VI: Data Visualisation: (Hours 8) Learn Tableau Basic Reports Parameters, Grouping Example 1, Grouping Example 2, Edit Groups, Set, Combined Sets, Creating a First Report, Data Labels, Create Folders, Sorting Data, Add Totals, Sub Totals and Grand Totals to Report. Learn Tableau Charts Area Chart, Bar Chart, Box Plot, Bubble Chart, Bump Chart, Bullet Graph, Circle Views, Dual Combination Chart, Dual Lines Chart, Funnel Chart, Traditional Funnel Charts, Gantt Chart, Grouped Bar or Side by Side Bars Chart, Heatmap, Highlight Table, Histogram, Cumulative Histogram, Line Chart, Lollipop Chart, Pareto Chart, Pie Chart, Scatter Plot, Stacked Bar Chart, Text Label, Tree Map, Word Cloud, Waterfall Chart, Geographic map, Filled map, Crosstab, Combines axis, Motion chart, Reference lines

Text Book:

Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)
7. All of statistics: a concise course in statistical inference. Larry Wasserman. Springer, 2004.
8. C. Bishop, Pattern Recognition and Machine Learning, Springer 2007
9. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009

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6KD02/6KS02 DESIGN & ANALYSIS OF ALGORITHM

Course Pre-requisite:

Any programming language, Discrete Mathematics and Data Structures.

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:

- To understand asymptotic analysis of algorithms.
- To apply algorithmic strategies while solving problems.
- Ability to analyze time and space complexity.
- Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome):

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

1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue: (Hours: 08)

Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion

Unit II: Divide And Conquer (Hours: 08)

Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Convex Hulls, Drawbacks of D & C & Timing Analysis.

Unit III: Greedy Methods (Hours: 08)

Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstra's Shortest Path Algorithm.

Unit IV: Dynamic Programming (Hours: 08)

Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.

Unit V: Backtracking (Hours: 08)

Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.

Unit VI: Efficiency of Algorithm (Hours: 08)

Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: "Design and Analysis of Algorithms" Pearson Education.

Reference Books:

1. Aho, Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P. Bratley: "Fundamentals of Algorithmics", PHI
3. Horowitz & Sahani: "Fundamental Algorithms", Galgotia.
Cormen, T.H, Lierson & Rivest: "Introduction to Algorithms", Mc Graw-Hill.

6KD03/6KS03 SOFTWARE ENGINEERING

Course Prerequisite:

Fundamentals of Programming Languages.

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:

- To learn and understand the principles of Software Engineering
- To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
- To apply Design and Testing principles to S/W project development.
- To understand project management through life cycle of the project.
- To understand software quality attributes.
- To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome):

On completion of the course, student will be able to:

1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

SYLLABUS

Unit I: Introduction to Software Engineering, Software Process Models (Hours: 06)

Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping, RAD, Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice

Unit II: Project Management: Process, Metrics, And Estimations & Risks (Hours: 06)

Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan

Unit III: Project Scheduling & Quality Management (Hours: 06)

Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering (Hours: 06)

System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design (Hours: 06)

Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing (Hours: 06)

Software testing fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, and system testing. Debugging. Technical metrics for software.

Text Book:

Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

Reference Books:

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

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6KD04 P.E. II - DATA WAREHOUSING & MINING

Course Objectives:

- To understand the principles of Data warehousing and Data Mining.
- To understand the Architecture of a Data Mining system.
- To perform classification, association, and prediction of data.

Course Outcomes: (Expected Outcome):

After completion of this course, the students should be able to:

1. Understand Data Warehousing principles, architecture, and DBMS schemas for Decision Support.
2. Master Data Mining functionalities, including preprocessing and system architecture.
3. Develop skills in Association Rule Mining and various association rule types.
4. Learn Classification and Prediction techniques, from Decision Trees to Ensemble Methods.
5. Acquire knowledge of Cluster Analysis methods and outlier detection.
6. Explore advanced mining techniques for Object, Spatial, Multimedia, Text, and Web Data.

SYLLABUS

UNIT I: Data Warehousing and Business Analysis (Hours: 07)

Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT II Data Mining (Hours: 07)

Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

UNIT III Association Rule Mining (Hours: 07)

Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT IV Classification and Prediction(Hours: 07)

Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Selection.

UNIT V Cluster Analysis (Hours: 07)

Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

UNIT VI Mining Object, Spatial, Multimedia, Text and Web Data (Hours: 07)

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Reference Books:

1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.
2. M.H. Dunham, “ Data Mining Introductory and Advanced Topics”, Pearson Education.
3. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

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6KD04 P.E. II - MACHINE LEARNING AND AI

Course Pre-requisite:

- Basic understanding of programming concepts and data structures.
- Familiarity with mathematical concepts such as algebra, probability, and statistics.

Course Objectives:

- Introduce core concepts and techniques of ML and AI.
- Provide theoretical foundation and practical skills for algorithm design.
- Explore supervised, unsupervised, and reinforcement learning paradigms.
- Enable application of ML algorithms for classification, regression, and clustering.
- Foster problem-solving abilities through hands-on projects.

Course Outcomes (Expected Outcome):

After completion of this course, the students should be able to:

1. Understand core ML and AI principles.
2. Apply algorithms like decision trees and neural networks effectively.
3. Analyze model performance and apply appropriate evaluation metrics.
4. Design and implement ML solutions for various tasks.
5. Critically evaluate different ML approaches.
6. Communicate findings clearly through reports and presentations.

SYLLABUS

Unit I: Introduction to Machine Learning (Hours: 07)

Overview of machine learning, Importance and applications of machine learning in AI, Basic concepts: supervised learning, unsupervised learning, reinforcement learning, Types of learning tasks: classification, regression, clustering, Concept Learning and the General-to-Specific Ordering - Concept learning as the foundation of machine learning, Formal definition of concept learning, General-to-specific ordering hypothesis, Candidate elimination algorithm, Issues and challenges in concept learning

Unit II: Decision Tree Learning (Hours: 07)

Introduction to decision trees, ID3 (Iterative Dichotomiser 3) algorithm, Entropy and information gain, Handling continuous-valued attributes, Pruning decision trees, Overfitting and methods for preventing it

Unit III: Artificial Neural Networks (Hours: 07)

Introduction to artificial neural networks (ANNs), Basic structure and function of neurons, Feedforward neural networks, Backpropagation algorithm, Activation functions, Applications of ANNs in pattern recognition and classification

Unit IV: Instance-Based Learning (Hours: 07)

Introduction to instance-based learning, k-nearest neighbors (k-NN) algorithm, Distance metrics and similarity measures, Lazy learning vs. eager learning, Pros and cons of instance-based learning

Unit V: Genetic Algorithms (Hours: 07)

Introduction to genetic algorithms (GAs), Basic principles of evolutionary computation, Genetic representation of solutions, Selection, crossover, and mutation operators, Applications of genetic algorithms in optimization and search problems

Unit VI: Reinforcement Learning (Hours: 07)

Introduction to reinforcement learning, Markov decision processes (MDPs) Policy iteration and value iteration, Q-learning algorithm, Temporal difference learning, Applications of reinforcement learning in robotics and game playing

Reference Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin
3. https://onlinecourses.nptel.ac.in/noc21_cs85/preview

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6KD04 P.E. II - NATURAL LANGUAGE PROCESSING

Prerequisite Course: Discrete Mathematics, Theory of Computation

Course Objectives:

- To be familiar with fundamental concepts and techniques of natural language processing (NLP)
- To acquire the knowledge of various morphological, syntactic, and semantic NLP tasks
- To develop the various language modelling techniques for NLP
- To use appropriate tools and techniques for processing natural languages
- To comprehend the advance real-world applications in NLP domain.
- To Describe Applications of NLP and Machine Translations.

Course Outcomes: (Expected Outcome):

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

1. Describe the fundamental concepts of NLP, challenges and issues in NLP.
2. Analyse Natural languages morphologically, syntactically and semantically.
3. Illustrate various language modelling techniques.
4. Integrate the NLP techniques for the information retrieval task.
5. Demonstrate the use of NLP tools and techniques for text-based processing of natural languages.
6. Develop real world NLP applications.

SYLLABUS

Unit I: Introduction to Natural Language Processing (Hours: 06)

Why NLP is hard? Programming languages Vs Natural Languages, Are natural languages regular? Finite automata for NLP, Stages of NLP, Challenges and Issues (Open Problems) in NLP Basics of text processing: Tokenization, Stemming, Lemmatization, Part of Speech Tagging

Unit II: Language Syntax and Semantics (Hours: 06)

Morphological Analysis: What is Morphology? Types of Morphemes, Inflectional morphology & Derivational morphology, Morphological parsing with Finite State Transducers (FST) Syntactic Analysis: Syntactic Representations of Natural Language, Parsing Algorithms, Probabilistic context-free grammars, and Statistical parsing Semantic Analysis: Lexical Semantic, Relations among lexemes & their senses Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Word Sense Disambiguation (WSD), Dictionary based approach, Latent Semantic Analysis

Unit III: Language Modelling (Hours: 06)

Probabilistic language modelling, Markov models, Generative models of language, Log-Liner Models, Graph-based Models N-gram models: Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, Word Embeddings/ Vector Semantics: Bag-of-words, TFIDF, word2vec, doc2vec, Contextualized representations (BERT) Topic Modelling: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis, Non-Negative Matrix Factorization.

Unit IV: Information Retrieval using NLP (Hours: 06)

Information Retrieval: Introduction, Vector Space Model Named Entity Recognition: NER System Building Process, Evaluating NER System Entity Extraction, Relation Extraction, Reference Resolution, Coreference resolution, Cross Lingual Information Retrieval

Unit V: NLP Tools and Techniques (Hours: 06)

Prominent NLP Libraries: Natural Language Tool Kit (NLTK), spaCy, TextBlob, Gensim etc. Linguistic Resources: Lexical Knowledge Networks, WordNets, Indian Language WordNet (IndoWordnet), VerbNets, PropBank, Treebanks, Universal Dependency Treebanks Word Sense Disambiguation: Lesk Algorithm WordNets for Word Sense Disambiguation

Unit VI: Applications of NLP (Hours: 06)

Machine Translation: Rule based techniques, Statistical Machine Translation (SMT), Cross Lingual Translation Sentiment Analysis, Question Answering, Text Entailment, Discourse Processing, Dialog and Conversational Agents, Natural Language Generation

Reference Books:

1. Jurafsky, David, and James H. Martin Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech PEARSON Publication
2. Manning, Christopher D., and rich Schütze Foundations of Statistical Natural Language Processing, Cambridge, MA: MIT Press

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6KD05/6KSO5 O.E. II - DATA COMMUNICATION & INTERNET

Course Pre-requisite: Basic Knowledge about Computer Fundamentals

Course Objectives: Throughout the course, students will be expected to:

- To develop an understanding of computer networking basics.
- To develop an understanding of different components of data communication, various protocols.
- To focus on information sharing and networks.
- To introduce flow of data, categories of network, different topologies.
- To study signals, transmission media, errors in media communications and their correction.
- To understand the building blocks of digital communication system.

Course Outcomes (Expected Outcome):

On completion of this course, the students should be able to:

1. Describe the general principles of Data Communication.
2. Independently understand basic computer network technology.
3. Understand and explain Data Communication System and its components.
4. Identify the different types of network topologies and protocols.
5. Identify the different types of network devices and their functions within a network.

SYLLABUS

Unit I: Introduction (Hours: 06)

Data Communication Networks, The Internet, Protocols and Standards.

Unit II: Network Models: (Hours: 06)

Layered Tasks, The OSI Model, Layers in the OSI Model, TCP / IP Protocol Suite, Addressing.

Unit III: Data and Signals (Hours: 06) Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data rate limits, performance.

Unit IV: Digital Transmission and Analog Transmission (Hours: 06)

Digital Transmission, Digital-to- Digital Conversion, Analog-to Digital Conversion, Transmission Modes. Analog Transmission: Digital-to- Digital Conversion, Analog-to Digital Conversion.

Unit V: Bandwidth Utilization and Transmission Media (Hours: 06)

Bandwidth Utilization, Multiplexing, Spread Spectrum. Transmission Media: Guided Media, Unguided Media, Wireless.

Unit VI: Switching, Using Telephone and Cable Networks for Data Transmission: Switching: Circuit-switched networks for Data Transmission (Hours: 06)

Telephone Network, Dial-up Modems, Digital Subscriber Line, Cable TV Networks, Cable TV for Data Transfer.

Text Book: Behrouz A. Forouzan: “Data Communication and Networking”, 4th Edition, Mc-graw Hill.

Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, fifth Edition, Pearson Education.
2. William L. Schweber: “Data Communication”, Mc-graw Hill.
3. J. Frey: “Computer Communication & Networks”, AEW Press.
4. D. Corner: “Computer Networks & Internet”, Pearson Education.

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6KD05/6KSO5 O.E. II - CYBER LAW & ETHICS

Course Pre-requisite: Basic Knowledge of Internet Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:

- Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
- Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
- Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
- Understand Criminal Liability, Cyber Crime implications and challenges.
- Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime

Course Outcomes (Expected Outcome):

On completion of this course, the students should be able to:

1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

SYLLABUS

Unit I: Information Technology & Cyber Crimes (Hours: 6)

Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, CyberWorld, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: Technology & Forms of Cyber Crimes (Hours: 06)

Influence of Technology on Criminality, Forms of Cyber Crimes. Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: Cyber Crimes 'and Global Response (Hours: 06)

Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000, Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: Mens Rea & Criminal Liability (Hours: 06)

Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: Cyber Crimes (Hours: 07) : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes : National and International Endeavors: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavors of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO), Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues.

Unit VI: Human Rights Perspectives Cyber Crimes (Hours: 07)

Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavors and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book: Dr. Pramod Kr. Singh, "Laws on Cyber Crimes [Along with IT Act and Relevant Rules]" Book Enclave Jaipur India.

Reference Books:

1. Craig B, “Cyber Law: The Law of the Internet and Information Technology”. Pearson Education.
Pawan Duggal, “Cyber Laws” Universal Law Publishing.
2. K.Kumar,” Cyber Laws: Intellectual property & E Commerce, Security”, First Edition, DominantPublisher, 2011.
3. Rodney D. Ryder, “Guide to Cyber Laws”, Second Edition, Wadhwa And Company, New Delhi, 2007.
4. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
5. Sharma, S.R., “Dimensions of Cyber Crime”, Annual Publications Pvt. Ltd., First Edition, 2004.
6. Augastine, Paul T., “Cyber Crimes and Legal Issues”, Crecent Publishing Corporation, 2007

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6KD06 SQL & VISUALIZATION Lab.

Course Prerequisite:

Basic concept of programming, Basic concepts of data structures

Course Objectives:

- To study the ER model which provides a high-level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model(relational model)for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome):

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

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

LIST OF EXPERIMENTS:

This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi

Practical 1: To Study a Database Modelling Tool.

Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modelling tool. The following basic features of the modelling should be covered while building the model:

- Logical / Physical Modelling
- Adding an entity / its attribute, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema.

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insertthe data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (%,_,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sortthe output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform

- Set membership operations
- In, not in
- Some All
- Exists and not exists, Test for emptiness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5. Study and implement aggregation functions.

- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions

- Write atleast 2 functions, and demonstrate its use
- Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)

HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus) A Simple Servlet., HTTP Servlet API Basics. HTML Form Processing in Servlets.

TEXT BOOK:

Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql ReferenceManual (for Mysql database)

REFERENCE BOOKS:

1. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O"Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
4. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719.

Data Visualisation: Basic list of experiments for learning Tableau:

Getting Started:

- Installation and Setup: Install Tableau Desktop or Tableau Public and get familiar with the interface.
- Connecting to Data: Import sample datasets or connect to a database to practice data importation.

Basic Visualization:

- Creating a Bar Chart: Visualize simple data using a bar chart.
- Line Chart: Create a line chart to represent trends over time.
- Pie Chart: Practice creating a pie chart to display proportions of a whole.
- Interactive Visualizations

Filters: Use filters to interactively explore data subsets.

Highlighting: Highlight specific data points or categories in your visualizations.

Heat Maps: Create a heat map to visualize data density or intensity.

Scatter Plots: Represent correlations between two variables using scatter plots.

Tree Maps: Use tree maps to display hierarchical data structures.

Dashboard Creation:

Building a Dashboard: Combine multiple visualizations into a dashboard layout.

Dashboard Interactivity: Add interactivity to your dashboard using actions and filters.

Dashboard Formatting: Customize the appearance and layout of your dashboard.

Mapping and Geographic Analysis:

Geographical Data Visualization: Plot data points on a map and customize map layers.

Spatial Analysis: Perform basic spatial analysis such as distance calculations or clustering.

Data Pre-processing basic operation using python.

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6KD07 DESIGN & ANALYSIS OF ALGORITHM Lab.

Course Prerequisite:

Any programming language, Discrete Mathematics and Data Structures

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:

- To understand asymptotic analysis of algorithms.
- To apply algorithmic strategies while solving problems.
- Ability to analyze time and space complexity.
- Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome):

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

1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments:

This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi

List of Experiments based on Syllabus: (Maximum 20)

1. Implement C programs to perform recursive calls using the following searching algorithms.
 - a. Linear Search when the list is given.
 - b. Binary Search when the given list is not sorted.
2. Study and analyze to sort an array of integers using merge sort.
3. Implement and analyze to sort an array of integers using quicksort.
4. Write a program to implement the Closest Pair of Points problem using the divide and conquer strategy.
5. Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23, 12, 3, 5, 89, 1, 24}
6. Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
7. Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
8. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
9. Implement programs to find minimum cost spanning trees from a given graph using Prim's algorithm.
10. Implement Prim's algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
11. Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.
12. Implement programs to find the shortest path in a given graph using Dijkstra's algorithm.
13. Implement programs factorial knapsack problem.
14. Develop a program to implement Strassen's matrix multiplication algorithm.
15. Implement programs to implement LCS problems using Dynamic Programming.
16. Develop a program to implement matrix chain multiplication problems using dynamic programming.
17. Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
18. Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
19. Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
20. Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

1. Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
2. Design and Implement Boyer Moore Algorithm for Pattern Searching.
3. Design and Implement Topological Sort of a graph using departure time of vertex.
4. Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
5. Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Book:

Dave and Dave: “Design and Analysis of Algorithms” Pearson Education.

Reference Books:

1. Aho,Hopcroft& Ullman “The Design & Analysis of Computer Algorithms”, Addison-Wesley
2. G. Brassard, P.Bratley: “Fundamentals of Algorithmics”, PHI
3. Horowitz & Sahani: “ Fundamental Algorithms” , Galgotia.
Cormen, T.H, Lierson& Rivest: “ Introduction to Algorithms”, Mc Graw-Hill.

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6KD08 EMERGING TECHNOLOGY Lab# II

Emerging Technology Lab. - II is based on 6KD04 Professional Elective-II
Data Warehousing & Mining: MySQL, PostgreSQL, Pentaho, RapidMiner

Machine Learning and AI: TensorFlow, scikit-learn, Apache Mahout, WEKA

Natural Language Processing: NLTK (Natural Language Toolkit), spaCy, Gensim

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6KD09 C Skill Lab IV (*)

The Practicals will be based on “Advanced Python”

NOTIFICATION

No. 97 /2024

Dated : 15 /08/2024

Subject: Chances for the Old Course failure students of Semester I & II of B.E./B.Text.E./B. Tech. (Chem. Engg.) (C.B.C.S.)

It is notified for general information of all concerned that the authorities of the University have accepted to provide Three (3) Chances i.e. Winter-2024, Summer-2025 and Winter-2025 for the Old Course failure students of Semester I & II of B.E./B.Text.E./B. Tech. (Chem.Engg.) of C.B.C.S. pattern to be implemented from the academic session 2024-2025 in view of implementation of NEP-2020 pattern for all the programmes of Engineering & Technology Courses from the Academic Session 2024-2025 onwards in phase wise manner which are as under:

Sr. No.	Old Course Subject Code	Name of Old Course Subject (C.B.C.S.)	Chances for the Old Course failures to be given
1	1A1	Semester: First/ Second Group A Engineering Mathematics I	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
2	1A2	Engineering Physics	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
3	1A3	Engineering Mechanics	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
4	1A4	Computer Programming	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
5	1B1	Semester: First/ Second Group B Engineering Mathematics I	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
6	1B2	Engineering Chemistry	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
7	1B3	Basic Electrical Engineering	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025
8	1B4	Engineering Graphics	Three (e) Chances i.e. Winter-2024, Summer-2025 and Winter-2025

Sd/-
(Dr.A.M.Asanare)
Registrar
Sant Gadge Baba Amravati University

NOTIFICATION

No. 98/2024

Dated : 15 /08/2024

**Subject: Additional Chances for the Old Course failure students of Semester I & II of B. Tech.
(Chem.Tech..) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.)**

It is notified for general information of all concerned that the authorities of the University have accepted to provide Three (3) additional Chances i.e. Winter-2024, Summer-2025 and Winter-2025 for the Old Course failure students of Semester I & II of B. Tech. (Chemical Technology.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology) of C.B.C.S. pattern to be implemented from the academic session 2024-2025 in view of implementation of NEP-2020 pattern to this programme of Engineering & Technology stream in phase wise manner which are as under:

Sr. No.	Old Course Subject Code	Name of Old Course Subject (C.B.C.S.)	Chances for the Old Course failures to be given
1	1SCT1	Semester I: Applied Inorganic Chemistry	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
2	1SCT2	Engineering Physics	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
3	1SCT3	Engineering Mathematics I	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
4	1SCT4	Computer Programming	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
5	1SCT5	Mechanical Technology	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
6	2SCT1	Semester II: Applied Physical Chemistry	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
7	2SCT2	Basic Electrical Engineering	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
8	2SCT3	Engineering Mechanics	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025
9	2SCT4	Engineering Graphics	Three (3) Chances i.e. Winter-2024, Summer-2025 & Winter-2025

Sd/-
(Dr.A.M.Asanare)
Registrar
Sant Gadge Baba Amravati University
