

## 2. B.Sc. CS Semester - V Syllabus

### B.Sc. CS Semester – V (Third Year)

**Subject Title** : Data Analytics and Visualizations  
**Subject Code** : CSM301-3C  
**Subject Type** : Major

#### Rationale:

In the contemporary data-driven world, the ability to extract meaningful insights from vast amounts of data is crucial. The subject "Data Analytics" aims to equip students with the essential skills and knowledge required to harness the power of data. This course provides an in-depth understanding of data analytics concepts, data manipulation techniques, data visualization, exploratory data analysis, and data preprocessing. The emphasis on practical applications using Python and its libraries ensures that students gain hands-on experience, making them proficient in handling real-world data science tasks. By mastering these skills, students will be well-prepared to tackle complex data challenges and contribute effectively to various industries and research domains.

#### Learning Outcomes:


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

- Understand the Fundamentals of Data Analytics.
- Master Python's Role in Data Analytics.
- Work Proficiently with NumPy.
- Perform Data Manipulation with Pandas.
- Conduct Exploratory Data Analysis (EDA).
- Acquire and Prepare Data for Analysis.

#### Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CEE (Formative)	SEE (Summative)	Total
4	30	60	50	50	100

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## Course Content:

**Unit I** [Weightage= 25% Approx., Lectures= 7, Practicals=14]

**Data Science:** Benefits and uses – facets of data – Data Analytics overview – types of Data Analytics, Understanding Python's Role in Data Science, Overview of important python libraries used in Data science.

**Working with NumPy:** Introduction to NumPy: Understanding Data Types in Python, The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations. Computation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data.

**Unit II** [Weightage= 25% Approx., Lectures= 8, Practicals=16]

**Data Manipulation with Pandas:** Introducing Pandas, Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data. Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas -eval() and query().

**Unit III** [Weightage= 25% Approx., Lectures=8, Practicals=16]

**Exploratory data analysis:** Data visualization using matplotlib library, creating graphs bar /line /pie /boxplot/ histogram, etc.), summarizing data, descriptive statistics,

**Measure of Central Tendency:** Mean, Median and Mode, Measure of Positions (Percentiles and Quantiles, Interquartile Range) Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation), univariate analysis (distribution of data), bivariate analysis (cross tabs, distributions and relationships, graphical analysis).


**Unit IV** [Weightage= 25% Approx., Lectures= 7, Practicals=14]

**Data Acquisition, Data Pre-processing and Preparation, Transformation:** Overview of Gather information from different sources: Web APIs, Open Data Sources, Data APIs, Web Scrapping, Data Munging, Data Wrangling, Data cleansing and handling missing values, outlier detection and treating the outliers Data imputation, understand various techniques for data imputation Data Transformation (minmax, log transform, z-score transform) Binning, Classing and Standardization.

### Text Books:

- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
- Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.
- Jake Vander plas, "Python Data Science Handbook: Essential tools for working with data", O'Reilly Publishers, I Edition.

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- Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012
- Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.

**Reference Books:**

- Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 1st edition, 2009.
- Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005.
- Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014

**Practical list:**

- Write a Python script to perform basic arithmetic operations.
- Create and manipulate lists, tuples, dictionaries, and sets.
- Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
- Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
- Computation on NumPy arrays using Universal Functions and Mathematical methods.
- Load an image file and do crop and flip operation using NumPy Indexing
- Create Pandas Series and Data Frame from various inputs.
- Import any CSV file to Pandas Data Frame and perform the following:
  - Visualize the first and last 10 records (b) Get the shape, index and column details
  - Select/Delete the records (rows)/columns based on conditions.
  - Perform ranking and sorting operations.
  - Do required statistical operations on the given columns.
  - Find the count and uniqueness of the given categorical values.
  - Rename single/multiple columns
- Import any CSV file to Pandas Data Frame and perform the following:
  - Handle missing data by detecting and dropping/ filling missing values.
  - Transform data using apply () and map() method.
  - Detect and filter outliers.
  - Perform Vectorized String operations on Pandas Series.
  - Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
- Create basic plots (line, scatter, bar) using Matplotlib.
- Generate statistical plots (histograms, box plots) using Matplotlib.
- Perform exploratory data analysis (EDA) with any available datasets. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.

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## B.Sc. CS Semester – V (Third Year)

**Subject Title** : Linux System and Administration  
**Subject Code** : CSM302-3C  
**Subject Type** : Major

### Rationale:

This subject is to introduce students to Linux operating systems and the principles of network administration. It provides a solid foundation in Linux system architecture, essential system management, network configuration, and security protocols through theory and practical exercises.

### Learning Outcomes:

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

- Explain the creation and evolution of Linux and compare it to other operating systems.
- Identify the skills required and challenges encountered by system administrators.
- Differentiate between Linux graphical interfaces and command-line utilities.
- Manipulate shell variables to configure and control the working environment.
- Process and format data at the command line and prepare files for printing.
- Edit and manage text files using the vi editor.
- Create and manage user and group accounts effectively.
- Configure and manage access permissions for files and directories.
- Demonstrate how to log in to a Linux system over a network connection and explain the differences from a Windows network connection.
- Use appropriate command-line tools for common network services like FTP and web access.
- Distinguish between network interfaces using command-line and graphical tools.
- Set up and manage a simple DHCP server and networked printing services.
- Plan and allocate hard disk space for a new Linux installation.
- Describe the steps involved in hardware initialization and starting a standard PC operating system.

### Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CCE (Formative)	SEE (Summative)	Total
4	30	60	50	50	100

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**Course Content:**

**Unit I** [Weightage=25% approx., Lectures=7, Practicals= 14]

**Introduction to Linux:** History and Overview of Linux, Linux Architecture and Features, Comparison with Other Operating Systems (Windows, macOS), Linux Distributions: Ubuntu, CentOS, Fedora, etc., Basics of Open-Source Software

**Linux Installation and Configuration:** System Requirements and Installation Process, Disk Partitioning and File Systems (ext4, NTFS, FAT), Boot Process and GRUB Configuration, Linux Directory Structure, Basic Commands for File and Directory Management

**Unit II** [Weightage=25% approx., Lectures=8, Practicals= 16]

**User and File Management:** User and Group Account Management, Permissions and Ownership (chmod, chown, and chgrp commands), File Compression and Archiving (tar, gzip, zip), File Management Utilities (find, locate, grep), Automating Tasks with Cron Jobs

**Shell Scripting:** Shell Basics and Types of Shells (bash, zsh), Writing and Executing Shell Scripts, Environment Variables and Aliases

**Unit III** [Weightage=25% approx., Lectures=7, Practicals= 14]

**Process Management:** Process Management (ps, top, kill, and jobs), Scheduling Processes with at and cron.

**Linux Networking Fundamentals:** Basics of Networking (TCP/IP, DNS, DHCP), Configuring Network Interfaces, Network Commands (ping, netstat, ifconfig, ip, traceroute), Managing Network Services (SSH, FTP, HTTP, and NFS), Firewall Configuration with iptables

**Unit IV** [Weightage=25% approx., Lectures=8, Practicals= 16]

**Network Administration:** Setting Up and Configuring DHCP Server, configuring a Web Server (Apache/Nginx), File and Printer Sharing with Samba,

**Securing the Network:** Firewalls, SELinux, and VPN, Monitoring Network Performance and Logs System and Kernel Administration, Managing Software Packages (apt, yum, rpm), System Initialization (systemd and init), Backup and Recovery Techniques, Monitoring System Resources (disk, memory, CPU usage)

**Reference Books:**

- Linux Bible by Christopher Negus
- Linux Command Line and Shell Scripting Bible by Richard Blum and Christine Bresnahan
- Unix and Linux System Administration Handbook by Evi Nemeth et al.

**Reference Links:**

- Linux.org, Ubuntu Documentation
- <https://www.server-world.info/en>
- <https://www.tutorialspoint.com/unix>

  
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## Practical List:

### Linux Basics

- Installation of CentOS/Linux OS:
  - Install CentOS in a virtual environment (e.g., VirtualBox or VMware).
  - Configure basic settings like hostname, timezone, and user accounts.
- Basic Command Line Operations:
  - File and directory management: ls, cd, mkdir, rm, cp, mv.
  - File permissions and ownership: chmod, chown.
  - Viewing and editing files using cat, nano, and vi.
- User and Group Management:
  - Create, modify, and delete users: useradd, usermod, userdel.
  - Manage groups and assign group permissions.

### Shell Scripting

- Introduction to Shell Scripting:
  - Write basic shell scripts to automate tasks.
  - Use variables, loops, and conditional statements.
- Backup Script:
  - Write a script to back up files and directories to a specified location.

### File Systems and Storage Management

- Disk Partitioning and Mounting:
  - Create and manage partitions using fdisk or parted.
  - Mount and unmount file systems and manage /etc/fstab.
- File System Management:
  - Format partitions with ext4, xfs.
  - Check disk usage with df and du.
- Backup and Recovery:
  - Perform file and directory backups using tar and rsync.

### Process and Service Management

- Process Management:
  - Monitor processes using ps, top, and htop.
  - Start, stop, and kill processes using kill and pkill.
- Service Management:
  - Manage services using systemctl and service.
  - Configure and troubleshoot startup services.

### Networking Basics

- Network Configuration:

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- Configure IP addresses manually and using DHCP.
- Test connectivity with ping, netstat, and traceroute.
- Network Utilities:
  - Set up and use ssh for remote login.
  - Transfer files using scp and rsync.
- Firewall Configuration:
  - Configure firewalld for opening and closing ports.
  - Manage NAT and packet filtering rules with iptables.

### Network Services

- Setting Up a Web Server:
  - Install and configure Apache or Nginx.
  - Deploy a sample website and troubleshoot issues.
- FTP Server Setup:
  - Install and configure an FTP server.
  - Manage user access and permissions.
- DNS and DHCP Configuration:
  - Set up a basic DNS server with bind.
  - Configure a DHCP server for automatic IP address assignment

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## B.Sc. CS Semester – V (Third Year)

**Subject Title** : Java Programming  
**Subject Code** : CSM303-3C  
**Subject Type** : Major

### Rationale:

This course introduces students to Object-Oriented Modeling and Design by covering key concepts such as object modeling, dynamic modeling, and functional modeling to understand system behavior. It provides a strong foundation in Java programming, emphasizing core principles, including Bytecode, JVM, data types, control structures, and object-oriented principles like inheritance, interfaces, and packages. Students will gain expertise in advanced topics like exception handling, file management through streams, and directory operations. Finally, the course covers graphical programming using applets and AWT components, equipping students with the skills to build interactive and visually dynamic applications.

### Learning Outcomes:


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

- Understand and apply object-oriented principles, including object, dynamic, and functional modeling, to analyse and design software systems effectively.
- Develop Java programs using core programming concepts, including Bytecode, JVM, data types, control structures, and classes.
- Implement advanced Java features such as inheritance, interfaces, packages, exception handling, and reflection to create robust and modular applications.
- Handle file management using streams, directories, and random-access files for efficient data storage and retrieval.
- Design and develop graphical and interactive applications using applets, graphics, threads, and AWT components.

### Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CCE (Formative)	SEE (Summative)	Total
4	30	60	50	50	100

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**Course Content:**

**Unit I** [Weightage=25% approx., Lectures=7, Practicals= 14]

**Introduction to Object-Oriented Modeling and Design**

Overview: Understanding Object-Oriented (OO) concepts and methodology, What is Object-Oriented? Object Modeling Concepts, Object-Oriented Methodology, Object-Oriented Themes

**Object Modeling Concepts:** Objects and Classes, Object modeling concepts in detail: Links, associations, Generalization and inheritance, Metadata and other OO concepts

**Dynamic Modeling Concepts:** Understanding dynamic behavior of systems, Creating dynamic models, Examples: Relation between object and dynamic models.

**Unit II** [Weightage=25% approx., Lectures=8, Practicals= 16]

**Functional Modeling:** Functional Modeling Concepts, Modeling functional behavior of system, Illustration: A sample functional model

**Fundamentals of Programming in Java:** Introduction to Java Programming, Bytecode, JVM, and Java buzzwords, Applications and applets, Data types, comments, variables, and initialization, Operators, control flow, arrays, and strings, Classes and methods.

**Unit III** [Weightage=25% approx., Lectures=7, Practicals= 14]

**Inheritance, Interfaces, and Packages:** Core Concepts, Casting, abstract classes, and protected access, Understanding Object: The Cosmic Superclass, The Class, class and reflection

**Collection Classes:** Introduction to Collections, List, Set, Map interfaces, ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap, Iterators and Enumeration, Generics in Collections.

**Unit IV** [Weightage=25% approx., Lectures=8, Practicals= 16]

**Exceptions:** Error Handling, Using try, catch, and finally, Understanding throw and throws Streams and Files, File Handling in Java, File and directories management, Byte streams and character streams, Random access files

**GUI Programming with AWT:** Introduction to GUI programming, AWT components: Frames, Panels, Buttons, And TextFields.

**Reference Books:**

- The Complete Reference: Java™ 2 by Herbert Schild
- Teach Yourself Java by Joseph O'Neil
- Object-Oriented Design by Rumbaugh

**Reference Links:**

- <https://www.javatpoint.com/java-tutorial>
- <https://www.javatpoint.com/java-ee>
- <https://www.w3schools.com/java>
- <https://www.tutorialspoint.com/java>

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## Practical List:

### Object-Oriented Modeling and Design

- Understanding Object-Oriented (OO) Concepts
  - Create a simple use-case diagram to model a real-world system (e.g., Library Management System).
  - Identify objects, classes, links, associations, and generalizations for the system.
- Object Modeling Concepts
  - Design a class diagram with inheritance, associations, and metadata for a Hotel Management System.
- Dynamic Modeling Concepts
  - Develop a sequence diagram to demonstrate the dynamic behavior of a system, such as an online shopping platform.
  - Create a state diagram for a traffic light management system.
- Functional Modeling Concepts
  - Design a data flow diagram to represent the functional behavior of a payroll system.
  - Model functional behavior for an ATM system with a sample functional model.

### Fundamentals of Programming in Java

- Java Basics
  - Write a Java program to demonstrate bytecode and JVM execution using simple input/output operations.
  - Create a Java program that uses data types, variables, and control flow statements (e.g., calculate factorial or Fibonacci series).
- Arrays and Strings
  - Implement a Java program to perform operations on arrays (e.g., sorting, searching).
  - Develop a program to demonstrate string manipulations (e.g., reversing, concatenation, or pattern matching).
- Classes and Methods
  - Write a program to demonstrate the concept of classes and methods, including method overloading and method overriding.

### Inheritance, Interfaces, and Packages

- Inheritance and Abstract Classes
  - Create a program to showcase single and multilevel inheritance, and use abstract classes for a Shape hierarchy (Circle, Rectangle, etc.).
- Interfaces and Packages
  - Develop a program using interfaces to implement multiple inheritance
  - Create custom packages and import them in a program to demonstrate modularization.

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- Java Collections Framework
  - Implement a program that uses an ArrayList to store and manipulate a list of student names.
  - Use a HashMap to store and retrieve student IDs and names.
  - Create a program to demonstrate the use of Set with unique values.

### Exceptions

- Error Handling
  - Write a Java program to demonstrate exception handling using try, catch, finally, throw, and throws.
  - Implement a custom exception class for validating user input (e.g., age, email).
- GUI Programming with AWT and Swing
  - Create a simple AWT application with buttons and text fields.

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## B.Sc. CS Semester – V (Third Year)

Subject Title : Software Testing and Quality Assurance  
Subject Code : CSE301-3C  
Subject Type : Minor

### Rationale:

The main objective of Software Testing and Quality Assurance is to give students the knowledge of very crucial discipline within Software Engineering and also enhance their skill for testing of software with different testing methods. It offers a solid basis for comprehending the software development lifecycle and its crucial relationship to testing by covering both manual and automated testing methodologies. In Quality assurance (QA) part students will learn about the importance of quality of software. The goal of a QA part is to provide students with a fundamental understanding of quality management principles and systems, and how they are used in the Software testing. On the completion of the units, students will understand the fundamentals of Software testing and be able to test the applications with the help of testing tools like Win runner, QTP, Selenium, JMeter etc.

### Learning Outcomes:

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

- Understanding software testing concepts.
- Identifying test techniques and test process.
- Defining test objectives.
- Ensuring Quality Attributes.
- Learning of Manual Testing and tools study for automated Testing.
- Learning the concept of Quality Assurance.

### Teaching and Evaluation Scheme:

Credits	Duration in Hours		Maximum Marks		Total
	Theory	Practical	CCE (Formative)	SEE (Summative)	
4	30	60	50	50	100

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**Course Content:**

**Unit I** [Weightage=25% approx., Lectures=8, Practicals= 16]

**Fundamentals of testing**

Definition and Importance of Testing, Software Development Life Cycle (SDLC) and Testing Lifecycle (STLC), Testing Objectives General testing principles Fundamental Test process: Test planning and control, Test analysis and design, Test implementation and execution, Evaluating exit criteria and reporting, Test closure activities

Testing throughout the software life cycle

**Test levels:** Unit testing, Integration testing, System testing, Acceptance testing – Alpha Testing, Beta Testing

**Verification and Validation:** Test types: Functional testing, Non-functional testing, Confirmation testing (Re-testing), Regression testing

**Unit II** [Weightage=25% approx., Lectures=8, Practicals= 16]

**Static techniques:** Static techniques and the test process, Review process: Phases of a formal review, Roles and responsibilities, Types of review – Informal Review, Walkthrough, Inspection

**Test design techniques:** The Test Development Process, Specification-based or black-box techniques, Equivalence partitioning, Boundary value analysis, Decision table testing, State transition testing, Structure-based or white-box techniques: Statement coverage, Decision (Branch) coverage, Experience-based techniques

**Types of System Testing:** Performance Testing, Load Testing, Stress Testing, Security Testing, Usability Testing, Smoke Testing, Compatibility Testing

**Unit III** [Weightage=25% approx., Lectures=7, Practicals= 14]

**Defect Tracking and Defect Reporting:** Bug Life Cycle Stages, Priority, Severity, Defect Prevention Meetings, Defect Parato charts.

**Software Quality Assurance (SQA):** Role of SQA in the Software Development Process, SQA vs. Testing, Quality Control, Quality Assurance, and Process Improvement

**Unit IV** [Weightage=25% approx., Lectures=7, Practicals= 14]


**Quality Assurance:** Quality Standards: Basic concept of – ISO 9000 & 9001, CMM, Six Sigma,

**Software Quality:** Quality attribute, Quality Assurance, Quality control & assurance, Methods of quality management, Quality management, Software quality metrics-TQM, Six Sigma, ISO, SQA Model

**Reference Books:**

- Foundation of Software Testing, Aditya P. Mathur, Fifth Edition 2011, Pearson Edition
- Software Testing Principles and Practices Naresh Chauhan Oxford University Press Publication

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- Software Testing, Yogesh Singh, Cambridge University Press

**Reference Links:**

- <https://www.javatpoint.com/software-testing-tutorial>
- <https://www.geeksforgeeks.org/software-testing-tutorial>
- [https://www.tutorialspoint.com/software\\_testing/index.htm](https://www.tutorialspoint.com/software_testing/index.htm)
- <https://artoftesting.com/software-testing-tutorial>

**Practical List:**

- Students are required to prepare a journal in which students need to write at least 30 test cases related to different business application domain
- Tool study related to bug tracking and testing using Bugzilla.
- Tool Study: Junit and Nunit Unit Testing tool.
- Tutorial based learning on Manual testing, Automated Testing Tools and its Case studies
- Study and Explore Testing tools Like QTP, Rational Robot, Winrunner, Loadrunner etc.
- Study and Explore Web based, GUI testing, Manual testing and Automated testing,
- Test Script generation and recording using Selenium.
- Tutorial based learning for Alpha and Beta Testing. (Case Study)

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## B.Sc. CS Semester – V (Third Year)

**Subject Title** : Data Warehousing and Data Mining  
**Subject Code** : CSE302-3C  
**Subject Type** : Minor

### Rationale:

This subject will teach the student about the concepts related to Enterprise Resource Planning, Data Warehousing and Data Mining. The processes and practices in business and their applications are taught in subject. Many important aspects related to ERP like the Best Practices, Functional Modules, and ERP vendors. Students will also learn about data warehouse architecture, components of data warehouse, Meta data for data warehouse, dimensional design, data cube, OLAP, and ETL process. Students will also learn Data Mining and KDD process.

### Learning Outcomes:

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

- Understand the conceptual model of ERP, the Evolution of ERP and Structure of ERP.
- Know about important ERP vendors like SAP, PeopleSoft, Baan, J.D. Edwards etc.
- Understand the Basic Functional Modules in ERP.
- Apply database analysis and design techniques of Data Warehousing.
- Construct a data model for Data Warehouse and Data Marts.
- Design dimensional model for a given subject area of a Data Warehouse.
- Understand data mining process and techniques.

### Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CCE (Formative)	SEE (Summative)	Total
4	60	-	50	50	100

### Course Content:

#### Unit I

[Weightage=25% approx., Lectures=15]

**ERP: Introduction to ERP:** ERP Concept, Reasons for the growth of the ERP Market, Conceptual Model of ERP, The Evolution of ERP, The Best Practices in ERP: The Concept of Best Practice, Style of Manufacturing, Manufacturing Industries, Project Industries, Service Industries, Concept of Customer Order Decoupling Point

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ERP Vendor Analysis: Introduction to Major ERP Vendors and their flagship product, SAP, Oracle, PeopleSoft, Baan, J.D. Edwards, Ramco, QAD

**Basic Functional Modules in ERP:** Manufacturing, Distribution, Financial, Item Control Module, BoM Module, Financial Accounting Module, Master Production Scheduling Module, MRP Module, CRP Module, Purchase Control Module

## Unit II

[Weightage=25% approx., Lectures=15]

**Introduction of Data warehousing:** Data Warehouse as defined by Inmon, Differences between OLTP & Data Warehouse, Comparative chart between OLTP and OLAP, Need to construct separate Data Warehouse

**Data warehousing–Architecture:** Three tier Data Warehouse Architecture, Components of a Data Warehouse, Data Cube, OLAP operations for multidimensional data, OLAP Servers (ROLAP, MOLAP, HOLAP), ETL process overview, Data Profiling, Change Data Capture, Data Cleaning, Data Integration and Transformation, Operational Data Store (ODS), Metadata for Data Warehouse

## Unit III

[Weightage=25% approx., Lectures=15]

Data warehousing –Design Dimensional modeling – introduction, Benefits of Dimensional Modeling, Fact tables and fact table keys, Dimension tables and dimension tables keys, Fact table granularity, Four step dimensional design process, Three Fundamental Grains, Surrogate Keys, Date Dimension, Multiple currencies and Units of measures, Factless fact tables, consolidated fact tables, Slowly Changing Dimensions and Technique for handling SCD, Concept Hierarchies, Degenerate Dimension, Conformed Dimension, Snowflake Schema

## Unit IV

[Weightage=25% approx., Lectures=15]

**Data Mining:** Introduction to Data Mining, KDD and Data Mining, Knowledge Discovery Process, Mining Frequent Patterns and Associations: Introduction to Association Rules Mining, Market Basket Analysis – an example, The Apriori Algorithm

**Classification and Prediction:** Introduction to classification and prediction, Comparison of classification and prediction methods, Naïve Bayesian Classification, Linear Regression, Non-linear Regression

**Cluster Analysis:** Introduction to cluster analysis, Types of data in cluster analysis, K-means – partitioning method

### Reference Books:

- Enterprise wide Resource Planning – Theory and Practice by Rahul V Altekar, PHI
- Enterprise Resource Planning, second edition by Alexis Leon, Tata McGraw Hill
- The Data Warehouse Lifecycle Toolkit – Ralph Kimbal, Margy Ross
- The Data Warehouse Toolkit - Ralph Kimbal, Margy Ross
- Data Warehousing in the Real World – Sam Anahory, Dennis Murray

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- Data Warehouse Toolkit – ETL process Ralph Kimball
- Data Mining Concepts and Techniques - Jiawei Han and MichelineKamber
- Introduction to Data Mining with Case Studies - G K Gupta

**Reference Links:**

- IBM Data Warehousing Guide → <https://www.ibm.com/topics/data-warehouse>
- Understanding Microsoft OLAP Architecture | Microsoft Learn
- MIT OpenCourseWare – Data Mining → <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/>
- Association Rule Mining (Apriori, FP-Growth)  
<https://www.kdnuggets.com/2016/04/association-rules-apriori-algorithm-tutorial.html>
- Decision Trees & Classification → <https://scikit-learn.org/stable/modules/tree.html>
- Clustering Techniques (k-Means, Hierarchical) → <https://scikit-learn.org/stable/modules/clustering.html>

Pandya BK  
01/04/25

*[Handwritten Signature]*  
Date: 01/04/2025  
Faculty of Computer Science  
Kadi Sarva Vishwavidyalaya  
Gandhinagar

## B.Sc. CS Semester – V (Third Year)

**Subject Title** : Project - V  
**Subject Code** : SEC341-3C  
**Subject Type** : SEC

### Rationale:

By studying the different theoretical and fundamental concept, students must ensure their learning by developing real time or scenario-based applications on the fundamental concept. The project development as a subject will help them to learn and understand the applications of the concept which they are learning from different subjects in the semester.

- Primarily, student must gain the knowledge about the applications of the fundamentals.
- Importantly, they need to also learn the technology trends and develop their skills on those technologies during project development.

### Learning Outcomes:

Students will be able develop their skills in analysis, design, development, testing and implementation through the development of small application.

### Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CCE (Formative)	SEE (Summative)	Total
2	-	60	25	25	50

### Course Content:

Here the emphasis will be given to the Study, Analysis, Design and Documentation for the selected application.

Students will design database as per normalization rules, and also create primary keys, foreign keys, constraints and necessary indices. All the tables should be populated with enough number of records to test functionality and show case the application features and reports

Project report should be prepared specifying requirement specifications and testing details in line with the requirement specifications. Technical design document should also be included typically with ER-Diagram, and architecture diagram.

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Project report shall be submitted including following details:

- Title Page (Having Full Name and Enrollment No).
- B.Sc.(CS) Department Certificate (Standard Format)
- Acknowledgement

For Above three documents Standard Format will be given by Department

- Index

**Contents in Index:**

- I. Scope
- II. Objective
- III. Functional Requirement

*Note:* (In-depth Application Specific), also include Reference taken from any website or some Existing System of any Company)

- IV. Tools & Technology

*Note:* (H/W & S/W Requirement).

- V. System Design

- o Entity Relationship Diagram
- o Data Dictionary.

*Note:* (Master Table Followed by Transaction Tables, where Sample Data needs to be included, which will show 10 records for each table. Constraints, data types with size and descriptions should be mentioned clearly)

- VI. Screen Layouts

*Note:* (With Data and Description)

**Please Note: Project will be evaluated based on Presentation / Project demonstration**

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