Module 1	**CH 1& 2 Introduction &Advanced SQL** **(Hours -7)**	1. Reviewing basic concepts of arelationaldatabase, Basic SQL 2. Complex Retrieval Queries using Group By, Recursive Queries, nested Queries 3. Specifying Constraints as Assertions; Event Condition Action (ECA) model (Triggers) in SQL; 4. Creating and working with Views in SQL; 5. Database Programming: Embedded SQL, 6. Dynamic SQL and SQLJ, 7. Database Programming with Function Calls: JDBC; Stored Procedures in SQL	**Purpose**: Student should beable toreview basic concepts of relational database management system.Demonstrate data and its types followed by record and file system. Explores evolution of database and define what database is. It also demonstrates entities, relationships, data models, database design and types of database. The real motivation is to acquire details of database basics with the structure of database.Introduces advanced SQL concepts such as Complex Retrieval Queries using Group By, Recursive Queries, nested Queries, Views, Constraints, Assertions, Event Condition Action (ECA) model Triggers and apply this advanced SQL concepts in database programming such as Embedded SQL, Dynamic SQL and SQLJ. **Scope –** **1. Academic Aspects-** fire complex SQL queries and being efficient to use that queries in application development.concepts. Explore basic as well as advanced SQL Queries including SQL Trigger, views, Store procedure, Embedded and Dynamic SQL,SQLJ. **2. Technology Aspect-** Student should be able to demonstrate basic relational database management system concepts. Able to fire complex SQL queries and being efficient to use that queries in application development. **3. Application Aspect-** Create database application which includes complex SQL queries. **Students Evaluation** – 1. Theory Questions to be asked on basic relational database management system concepts. 2. Lab experiments on Basic as well as complex SQL Queries. 3. Corresponding viva questions can be asked on Advanced SQL Queries, Embedded SQL, Dynamic SQL and SQLJ.	**Understand** the basic relational database management system concepts. **Understand** the Complex SQL Queries. **Understand** the concepts of Embedded and Dynamic SQL, SQLJ. **Analyze**usage of Complex SQL Queries and use them in application development. **Determine**the drawbacks of Traditional File System and how those can be overcome using Database Approach. **Explore**Advanced SQL Queries. **Create**database application which includes complex SQL queries.
Module 2	**CH 3 AdvancedTransactionProcessing&Recovery** **(Hours -6)**	1. Review of ACID properties andSerializability; 2 . MultiversionConcurrencyControl Techniques; 3. GranularityofDataItems and MultipleGranularityLocking 4. Advanced DatabaseRecoverytechniques likeWrite AheadLogging(WAL), 5. ARIES, Checkpoints.	**Purpose** – Student should be able to demonstrate ACID Properties. Define: Transaction, states of transaction, Serializability, Concurrency Control Granularity of Data and Database Recovery.This unit introduces with transactions and concurrent transactions in DBMS which include schedule in transaction and problems in concurrent transaction. It also explains Serializability and recoverability. Motivation of this unit is to learn advanced Concurrency Control Techniques like Multi-version Concurrency Control and advanced Database Recovery techniques like Write Ahead Logging (WAL), ARIES and Checkpoints **Scope –** **1. Academic Aspects-** Learning fundamentals of ACID Properties, Define: Transaction, states of transaction, Serializability, Concurrency Control Granularity of Data and Database Recovery. **2. Technology Aspect-**Implementation of Concurrency Control, Advance Transaction Processing and Database Recovery techniques. **3. Application Aspect-** Analyze and Implement Advance Transaction Processing and Database Recovery techniques as per need in database.	List and explain ACID properties and Serializability. List the states of transactions such as start, partially committed, abort. Demonstrate the concepts of Advance Transaction Processing and Advanced Database Recovery techniques. Explore Concurrency Control Mechanisms and hands-on experimentation. **Analyze**and Implement Advance Transaction Processing and Database Recovery techniques as per need in database.

			Students Evaluation 1. Questions on Concurrency Control, Advance Transaction Processing and Database Recovery techniquesetc. 2. Explain Advance Transaction Processing concepts such as Multiversion Concurrency Control, Granularity of Data Items and Multiple Granularity Locking. Explain Advanced Database Recovery techniques like Write Ahead Logging (WAL), ARIES and Checkpoints. 3. Student should be able to Analyze and Implement Advance Transaction Processing and Database Recovery techniques as per need in database.	
Module 3	**Chapter 4 & 5 DataSecurity &Storage andIndexing(Hours -8)**	1. IntroductiontoDatabaseSecurityIssues; DiscretionaryAccessControlBasedonGrantingandRevokingPrivileges; 2. MandatoryAccessControlandRole-BasedAccessControlfor Multilevel Security; 3. SQLInjection;IntroductiontoStatistical DatabaseSecurity, 4. Introduction to Flow Control 5. Operation on Files; hashing Techniques; 6. Types of Single-Level Ordered Indexes; Multilevel Indexes; 7. Dynamic Multilevel Indexes Using B- Trees and B+-Trees; 8. Indexes on Multiple Keys.	**Purpose- S**tarts with introduction of data security issues then discusses techniques for securing databases against a variety of threats. Also discusses discretionary access control, mandatory access control and role based access control mechanism. It also presents schemes of providing access privileges to authorized users. Some of the security threats to databases; such as SQL Injection. Introduction of storage of data in database followed by Storage and Indexing concepts which includes Operation on Files, hashing Techniques, Types of Single-Level Ordered Indexes, Multilevel Indexes, Dynamic Multilevel Indexes Using B- Trees and B+-Trees, Indexes on Multiple Keys. **Scope –** **1. Academic Aspects-** Learning fundamentals of DatabaseSecurityIssues. Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, SQLInjection, StatisticalDatabaseSecurity, Operation on Files; hashing Techniques, Types of Single-Level Ordered Indexes; Multilevel Indexes, Dynamic Multilevel Indexes Using B-Trees and B+-Trees. **2. Technology Aspect-** Student will learn Data Security, Storage and Indexing concepts. Design and implement storage and indexing concepts as per requirement of application and database. **3. Application Aspect-** Implement prevention of SQL injection and flow control in application and database by writing a SQL logic for data hacking for weak security by using concept of SQL injection. **Students Evaluation –** 1. Explain Data Security issues. 2. Explain Mandatory and Discretionary access control. 3. Explain Dynamic Multilevel Indexes Using B-Trees and B+-Trees 4. Explain Single-Level and Multilevel ordered Indexes 5. Explain Multiversion Concurrency Control Techniques.	ExplainDatabaseSecurity **Understand**Multilevel Security List and identify data security issues explain various Access Control mechanisms. **Explain**discretionary and mandatory access control **Explore**different types of attacks. Implement prevention of SQL injection and flow control in application and database by writing a SQL logic for data hacking for weak security by using concept of SQL injection. **Understand**hashing in database, **Explore**Operation on Files. Demonstrate dynamic Multilevel Indexes Using B- Trees and B+-Trees, Indexes on Multiple Keys.

Module 4	**Chapter 6 & 7 DistributedDatabases&ObjectBasedDatabases(Hours -11)**	1. Types of Distributed DatabaseSystems; 2. Distributed DatabaseArchitectures; 3. Data Fragmentation,ReplicationandAllocationTechniquesforDistributedDatabase Design; 4. QueryProcessingandOptimizationinDistributedDatabases; 5. OverviewofTransactionManagementinDistributedDatabases; 6. OverviewofConcurrencyControlandRecoveryinDistributedDatabases. 7. Overview of Object Database Concepts; Object-Relational Features; 8. Object Database Extensions to SQL; 9. The Object Definition Language ODL; 10. Object Database Conceptual Design; 11. The Object Query Language OQL.	**Purpose-** Students should be able to demonstrate basics of DDBMS along with its advantages and disadvantages. It also consists of mainly five phases: Basics of Distributed Database system, types of distributed database system, distributed database architecture, data fragmentation replication and allocation techniques for distributed database design and overview of concurrency control and recovery in distributed databases. This unit starts with introduction of Object Based Databases concepts and comparison between traditional and Object Based Databases, followed it discusses the features of object oriented data models and show how some of these features have been incorporated in relational database systems. Object-oriented databases are now referred to as object databases (ODB) (previously called OODB), and the database systems are referred to as object data management systems (ODMS). **Scope -** **1. Academic Aspects-** Student will learn various Distributed & Object Based Databases concepts such as its application, usage and Implementation. **2. Technology Aspect-** Implement Vertical and horizontal fragmentation in SQL server. Implement object query using ODL and OQL. **3. Application Aspect-** **To analyze and apply**various Distributed & Object Based Databases concepts. **Students Evaluation –** 1. Explain Fragmentation, Replication and allocation technique for data base design. 2. Explain Concurrency control and recovery technique in Distributed Database. 3. Define object, atom, object identifier, ODL, OQL. 4. Explain Object oriented concepts, Object Database Conceptual Design.	Identify types distributed data base system. Explain vertical, horizontal and hybrid fragmentation. Demonstrate Concurrency control and recovery technique in Distributed Database. Implement Vertical and horizontal fragmentation in SQL server. DescribeObject-Relational Features. Explain Object oriented concepts, Object Database Conceptual Design. Implement object query using ODL and OQL.
Module 5	**Chapter 8 & 9** **Introductiont o Data Warehousing &DimensionalModeling** **(Hours -8)**	1. TheNeedforData Warehousing;IncreasingDemandforStrategicInformation;InabilityofPastDecisionSupportSystem;OperationalVsDecisionalSupport System; 2. Data WarehouseDefined;BenefitsofData Warehousing ; FeaturesofaDataWarehouse;TheInformationFlowMechanism;RoleofMetadata;ClassificationofMetadata;DataWarehouseArchitecture;DifferentTypeso	**Purpose –** Student should able to demonstrate introduces significance of data warehousing and its need of implementation. It also discusses inability of past decision support systems, difference between operational and decisional support system. It then demonstrate benefits, features of data warehousing, data warehousing architecture and design techniques of data warehouse. Introduction of dimension modelling. Followed by comparing data warehouse modelling and operational database modelling, Data modelling and ER modelling. It discusses features of Dimension modelling, schemas such as star schema, snowflake schema, and various keys. Motivation of this module is to learn how to bring together data from many different sources and create a single, consistent user view.	Demonstrate benefits and features of a Data Warehouse. List different types of architecture. Explain Data Warehousing concepts such as data mart, Meta Data, Decision Support System and Data Warehousing Design Strategies. Design and implement Data Warehouse for given problem definition. Illustrate Features of a Good Dimensional Model and Keys in the Data Warehouse Schema. Demonstrate dimensional modeling concepts such as Data Warehouse Modeling, Operational Database Modeling, Dimensional Model, ER Model, Various schemas and keys.

		fArchitecture;DataWarehouseandDataMarts;DataWarehousingDesignStrategies. 3. DataWarehouseModelingVsOperationalDatabaseModeling; 4. DimensionalModelVsERModel;FeaturesofaGoodDimensionalModel; 5. TheStarSchema;HowDoesaQueryExecute?TheSnowflakeSchema; 6. FactTablesandDimensionTables:;heFactlessFactTable;UpdatesToDimensionTables:SlowlyChangingDimensions,Type1Changes,Type2Changes,Type3Changes, 7. LargeDimensionTables,RapidlyChangingorLargeSlowlyChangingDimensions,JunkDimensions, 8. KeysintheDataWarehouseSchema,PrimaryKeys,SurrogateKeys&ForeignKeys;AggregateTables;FactConstellationSchema orFamilies of Star.	**Scope –** **1. Academic Aspects-** Students will learn Data Warehousing and Data Modelling concepts. **2. Technology Aspect-** **Students will be able to identify need of** Data Warehousing and modelling concepts and accordingly can apply learned concepts in designing and implementing Data Warehouse. **3. Application Aspect-** Design and implement Data Warehouse for given problem definition. Design and implement Star Schema, Snowflake Schema, Fact Tables and Dimension Tables for given problem definition. **Student Evaluation -** 1. What is data warehouse? Give definition and features of data warehouse? 2. Describe architecture of data warehouse with block diagram? 3. Write short note on decision support system? 4. Describe fact and dimensional table in detail? 5.Differentiate between ER modeling and dimensional modeling? 6. Differentiate between data mart and data warehouse?	Design and implement Star Schema, Snowflake Schema, Fact Tables and Dimension Tables for given problem definition.
Module 6	**Chapter 10 &11 ETL Process&OnlineAnalyticalProcessing(OLAP)** **(Hours -8)**	1. ChallengesinETLFunctions;DataExtraction; 2. IdentificationofDataSources;ExtractingData:ImmediateDataExtraction,DeferredDataExtraction; 3. DataTransformation:TasksInvolvedinDataTransformation, 4. DataLoading:TechniquesofDataLoading,LoadingtheFactTablesandDimensionTablesDataQuality;Issues in DataCleansing. 5. NeedforOnlineAnalyticalProcessing;OLTPvsOLAP; 6. OLAPandMultidi	**Purpose –** Student should understand,mostly the information contained in a warehouse flows from the same operational systems that could not be directly used to provide strategic information. What constitutes the difference between the data in the source operational systems and the information in the data warehouse? It is the set of functions that fall under the broad group of data extraction, transformation, and loading (ETL). Users certainly need the ability to perform multidimensional analysis with complex calculations, but we find that the traditional tools of report writers, query products, spreadsheets and language interfaces are distressfully inadequate. What is the answer? Clearly, the tools being used in the OLTP and basic data warehouse environments do not match up to the task. We need different set of tools and products that are specifically meant for serious analysis. We need OLAP in the data warehouse.	ExploreETL Functions. List Data Loading Techniques, Issues in Data Cleansing. Demonstrate concepts of ETL such as ETL Functions, Immediate and Deferred Data Extraction, Tasks involved in Data Transformation Demonstrate techniques of Data Loading, Loading the Fact Tables and Dimension Tables. Implement efficient organization of data by identifying various task related to ETL process and implement them. Identify need for OLAP. List and explain OLAP and Multidimensional Analysis. Demonstrate OLAP, ROLAP, MOLAP, HOLAP, with example. Implement efficient retrieval and presentation of data by implementing OLAP, ROLAP, MOLAP and HOLAP as per

		mensionalAnalysis ;Hypercubes; 7. OLAPOperationsinMultidimensional DataModel; 8. OLAPModels:MOLAP,ROLAP, HOLAP, DOLAP	**Scope –** **1. Academic Aspects-** **Students will learn** ETL Process & Online Analytical Processing (OLAP) concepts. **2. Technology Aspect-** Design and Implement efficient organization of data by identifying various task related to ETL process and implement them. Design and Implement efficient retrieval and presentation of data by implementing OLAP **3. Application Aspect-** Design and Implementation of ETL and OLAP Concepts.	requirement.
			Student Evaluation - 1. Write short note on decision support system? 2. Describe fact and dimensional table in detail? 3. Explain step in ETL process? 4. Explain Deferred data extraction and Immediate data extraction 5. Explain OLAP and discuss its applications? 6. Explain types of OLAP with its advantages and disadvantages?	