LESSON PLANS

FOR

ODD SEMESTER

(July, 2022 to December, 2022)

SESSIONS

2022-2023

DEPARTMENT OF COMPUTER SCIENCE

Gopinath Bordoloi Nagar, Gauhati University

Guwahati-781014, Assam, India

LESSON PLAN

Subject Name : **Advanced Database Management System**

Paper Code : **CSC1056/INF1056** **Session:** **2022-2023**

Program Name : **M.Sc. (CS/IT)** **Semester:** **Second**

Faculty Name : **Dwipen Laskar**

Date : **01/08/2022 to 12/12/2022**

Detailed Lesson Plan

UNIT-I (Relational Model)

Lecture No	Topics to be Covered
1	Introduction to DBMS, File Processing System, Advantages and Disadvantages of DBMS
2	Relational model concepts, Data Models in DBMS, Relational databases, schemas, Instances
3	Three-tier architecture of a DBMS, Data Independence (Physical and Logical)
4	Basic concepts of Relational Data Model, Types of Constraints in Relational Model,
5	Various types of Keys in DBMS, Relational algebra operations (SELECT, PROJECT)
6	Relational algebra operations (RENAME, UNION, INTERECTION, DIFFERENCE,CARTESIAN PRODUCT)
7	JOIN operations-INNER JOIN (THETA, NATURAL, EQUI)
8	JOIN operations-OUTER JOIN (LEFT, RIGHT, FULL,DIVISON)
9	Extended Relational Operators (Extended Projections, Aggregate Functions)
10	Relational Calculus (Tuple Relational Calculus, Domain Relational Calculus)
11	Database Languages(DDL, DML, TCL, DCL), SQL statements (CREATE, DROP)
12	SQL statements (ALTER, DELETE, SELECT, WHERE, LIKE, BETWEEN, IN)

UNIT-II (Semantic Modelling)

13	Introduction to E-R model, Query Tree, Modeling using ER diagram
14	Primitives of E-R diagrams, Relationship in ER diagram, Types of Relationships (Unary, Binary, Ternary, Recursive, N-ary),
	Types of Entities (Strong and Weak), Types of Attributes

15	Constraints on Binary Relationships: Cardinality ratio, Mapping Cardinalities (One to One, One to Many, Many to One, Many to Many)
16	Participation Constraints (Total and Partial), Design of database with E-R model
17	Transformation of ER model to relational schema (Strong Entity, Weak Entity, Composite and Multi-valued Attribute)
18	Transformation of ER model to relational schema (One to One relationship, Many to One, One to many and Many to Many Relationship)
19	Enhanced ER diagram, Generalization, Specialization, Constraints on Specialization and Generalization, Membership Constraints, User Defined, attribute-defined
20	Completeness Constraint, Hierarchy and lattice, Union or Category, Aggregation,
21	Mapping specialization/generalization to relational tables, Relational Database Design by ER-to-Relational Mapping, Transformation of EER model to relational schema

UNIT-III (Normalization and Functional Dependency)

20	Concept of Functional Dependency, Types of Functional Dependency,
21	Armstrong's Axioms of Functional Dependency, Dependency-preserving property
22	Lossless join property, Equivalence of sets of functional dependencies
23	Algorithms to ensure dependency -preserving property and lossless join property
24	Finding out Candidate keys from a given FD set, Cover of Functional Dependency, Equivalent set of Functional Dependency Sets with Examples,
25	Canonical Cover of a Functional Dependency Set, Algorithm of minimal cover, Closure of Functional Dependency, Cover of FD
27	Definition of Normalization, Concept of Insertion, Deletion, Updation anomalies
28	Definition and Concept of 1NF, 2NF, Conversion of a relational into 1NF and 2NF
29	Definition and Concept of 3NF, BCNF, Conversion of a relational into 3NF and BCNF
30	Definition and Concept of 4NF, 5NF, Conversion of a relational into 4NF and 5NF

UNIT-IV (System implementation techniques)

31	Query processing and optimization- translation between SQL queries and relational algebra
32	Transaction processing- transaction and system concepts, desirable properties, Transaction States, Concurrent Transactions ,
33	Serializable Schedules (Serializability: Serial, Nonserial, and conflict Serialiable),
34	Locking Techniques: Types of Locks, Two Phase Locking (2PL), Guaranteeing Serializability by Two Phase Locking, Timestamp based protocols
35	Database Recovery- concepts and techniques, recovery in multi-database systems Kinds of failures, Failure controlling methods (Log base recovery, shadow copy scheme, heckpoints,
36	Concurrency control- locking techniques, concurrency control based on timestamp ordering, multiversion concurrency control techniques
37	Database recovery concepts, Log Based Recovery, Shadow Paging , Security and authentication- issues
38	Access control techniques: Types of Discretionary Privileges, Mandatory Access Control for Multilevel Security

UNIT-V (Object Oriented Database System)

39	Concepts of object-oriented databases; Standards, languages(Object Data Management Group (ODMG)), Advantages and Disadvantages of OODBMS
40	Limitation of Relational Databases, The Need for Object Oriented Databases, Object Oriented Data Model
41	Need of Complex Data Types, Object Structure, Message and Methods, Object and Classes
42	Inheritance, Polymorphism, Inheritance, Encapsulation, Abstraction, Associations
43	ODMG Object Definition Language, Mapping Object-Oriented Conceptual Models to ODL

UNIT-VI (Distributed Database System)

44	Introduction of Distributed Databases, Distributed System Architecture, Design Issues, Data Fragmentation, Data fragmentation, replication, and allocation techniques
45	Features of Distributed Databases-Distributed databases versus Centralized Databases
46	Types of distributed database systems, Principles—Levels Of Distribution-Transparency-Reference Architecture- Types of Data Fragmentation
47	Integrity Constraints in Distributed Databases- Architectural Issues- Alternative Client/Server Architecture
48	Query processing in distributed databases, Overview of concurrency control and recovery in distributed databases.
49	Distributed Query Processing: Query Transformation, Simple JOIN processing,
50	Distributed Transaction Processing, Transaction System Structure, Types of transactions (Local and Global Transactions), System Failure Models,
51	Distributed Concurrency Control, Approaches: Single lock Manager Approach 2), Distributed lock Manager Approach
52	Deadlock Handling in Distributed Database System

UNIT-VII (Image, multimedia, and spatial databases)

53	Concepts of Image, multimedia, and spatial databases
54	Content-based indexing and retrieval
55	Indexing techniques- R trees, Properties of R-tree, Applications of R-Tree
56	Indexing techniques-R+ trees, KD trees.

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LESSON PLAN

Subject Name : **Distributed System**

Paper Code : **CSC3026/INF3026** **Session:** **2022-2023**

Program Name : **M.Sc. (CS/IT)** **Semester:** **THIRD**

Faculty Name : **Dwipen Laskar**

Date : **01/08/2022 to 12/12/2022**

Detailed Lesson Plan

UNIT-I (Introduction to Distributed Systems)

Lecture No	Topics to be Covered
1	Definition of a distributed system. Characteristics of distributed and centralized systems
2	Design issue and challenges, Advantages and Disadvantages of Distributed System
3	Types of transparency issues, Concurrency Control, openness, and scalability.
4	Hardware concepts- multiprocessors, homogeneous & heterogeneous systems, middleware, issues in distributed Operating systems
5	Inherent limitations of distributed systems,
6	System models: Fundamental model
7	System models: Architectural model
8	System models: Interaction model
9	System architectures- The client-server model and its variations
10	Application layering, Client-Server architectures.

UNIT-II (Synchronization)

11	Needs of clock synchronization, External and Internal clock synchronization, Global Clock
12	Logical and Physical Clock Synchronization, Logical and vector clocks, Happened Before Relationship,
13	Lamport's logical clock synchronization algorithm, Limitations of Lamport's Clock
14	Vector clock synchronization, Partial Ordering of Events
15	Causal Order of messages, Birman-Schiper-Stephension protocol

16	Schiper-Eggli-Sandoz protocol: Algorithm, Solutions with examples
17	Global state, Chandy Lamport snapshot algorithm
18	Termination detection, Haung's Termination Detection Algorithm

UNIT-III (Distributed Mutual Exclusions)

19	Definition of Distributed ME, Critical Section, Requirements of Mutual Exclusion algorithms
20	Performance measurement metrics for Distributed ME algorithms, Classification of mutual exclusion algorithm- Token based algorithms, Non-token based algorithm, Quorum Based
21	Central Server Algorithm, Complexities of CS Algorithm, Merits and Demerits
22	Lamport's timestamp algorithm, Complexities of CS Algorithm, Merits and Demerits
23	Ricart-Agrawala Algorithm, Complexities of CS Algorithm, Merits and Demerits
24	Maekawa's Voting algorithm, Complexities of CS Algorithm, Merits and Demerits
25	Ring based algorithms, Complexities of CS Algorithm, Merits and Demerits
26	Suzuki-Kasami's Broadcast algorithm, Complexities of CS Algorithm, Merits and Demerits
27	Raymond's Tree-based algorithm, Complexities of CS Algorithm, Merits and Demerits
28	Election algorithms- Bully algorithm, Ring algorithm, Lelang-Chang-Robert Algorithms

UNIT-IV (Distributed Scheduling and Deadlock detection)

30	Distributed scheduler, issues in distributed load distribution,
31	Components of load distribution algorithm, Stability, Task Migration
32	Basic conditions of deadlocks, Resource and communication deadlock, Strategies of deadlock handling, Necessary conditions of deadlock
33	Issues in deadlock detection and resolution, False Deadlock, Deadlock detection algorithms (Centralized, Distributed , Hierarchical)
34	Completely Centralized Algorithm, HO Ramamurthy (One and Two Phase Algorithm)
35	Distributed Deadlock Algorithm-Path Pushing Algorithm, Edge Chasing Algorithm, Diffusion Computation based and Global State detection algorithm

UNIT-V (Agreement Protocols and Inter-process Communication)

36	System models, classification of agreement problems (Byzantine, Consensus, Interactive), Relations among Agreement Protocols
37	Solutions to the Byzantine agreement problem-Upper bound on number of faulty processors, Treatment of Impossibility Results, Lamport's-Shostak-Pease Algorith,
38	Dolev et at's algorithm, Applications of agreement algorithms
39	Inter-process Communications, API for UDP/TCP, Request Reply Protocol, Remote Procedure Call- basic RPC operation, parameter passing, examples.

40	Remote Object Invocation- distributed objects, integrating clients and objects, static versus dynamic RMI, parameter passing, examples and case study

UNIT-VI (Naming)

41	Naming entities- names, identifiers & addresses, name resolution
42	Name space implementation, the Domain Name System.

UNIT-VII (Distributed Transaction Processing)

43	Distributed transactions- ACID properties, flat and nested transactions
44	Atomic commit protocols, concurrency control in distributed transactions
45	Introduction, reasons for replication, object replication, consistency models
46	Failure Recovery in Distributed System-Classification of failures, Backward and Forward Failure Recovery,
47	Backward Failure Recovery: Operation based recovery and State based recovery, State based approach
48	Recovery in Concurrent System: Orphan messages and Domino effects, Lost messages, Problem of Livelock
49	Consistent Set of Checkpoints, Synchronous Check pointing and Recovery, Koo and Toueg check pointing algorithm

UNIT-VIII (Distributed File Systems)

50	Introduction: characteristics of file systems, distributed file system requirements, File service architecture, Services provided by DFS
51	File accessing models, Architecture of DFS, Advantages and Disadvantages, detailed case study of Sun Network File System (NFS)
52	Distributed Shared Memory, Advantages and disadvantages of DSM, Algorithms for Implementing DSM
53	Central Server algorithm, Migration Algorithm, Read Replication algorithm, Full-Replication Algorithm
54	Security in distributed system, Types of threats, Types of attacks
55	Security policy and mechanisms, Design Issues for security in Distributed System
56	Introduction to cryptography, Symmetric and Asymmetric Key cryptography, RSA Algorithm

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