

**DEPARTMENT OF COMPUTER SCIENCE**

**Gopinath Bordoloi Nagar, Gauhati University**

**Guwahati-781014, Assam, India**

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**

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|  | **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 |

(**Dwipen Laskar**)

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