LESSON PLANS

FOR

ODD SEMESTER

(July, 2018 to December, 2018)

EVEN SEMESTER

(Jan, 2019 to June, 2019)

SESSIONS

2018-2019

COURSE CODE**: CSC3026**	L-T-P**: 4-1-1**
COURSE NAME**: DISTRIBUTED SYSTEMS**	CONTACT HOURS/WEEK**: 7**
COURSE TYPE**: CORE**	TOTAL MARKS**: 100 (**INTERNAL**: 60,** EXTERNAL**: 40)**
NUMBER OF CREDITS**: 6**	NATURE**: GRADED**

COURSE OBJECTIVES:

1. To provide students the concepts of basic architecture and components of distributed systems
2. To familiarize the students with the concepts of various distributed algorithms.
3. To give students the concepts of concurrency controlling and distributed file system handing

COURSE PREREQUISITE:

- Basic concepts of Operating Systems and basic concepts of Computer networks

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Explain the architecture and different system models of distributed systems.
- Analyze different process synchronization, Global state recording and termination detection algorithms in distributed systems.
- Compare different Mutual Exclusion, leader election algorithms, different distributed file structures
- Distinguish the Inter-process communication methods and analyze the idea of failure handling, concurrency management and Security handling issues

COURSE CONTENT:

Unit No & Name	Components of the Unit	No of contact hours	Marks
UNIT-I: **Introduction to Distributed Systems**	• Definition of a distributed system. Characteristics of distributed and centralized systems, Design issue and challenges, types of transparency issues, openness, and scalability. Hardware concepts- multiprocessors, homogeneous & heterogeneous systems, middleware, issues in distributed Operating systems, inherent limitations of distributed systems	18	20

	• System models: Fundamental and Architectural model, System architectures- The client-server model and its variations, application layering, client-server architectures.		
UNIT-II: **Synchronization**	• Needs of clock synchronization, external and internal clock synchronization, Logical and vector clocks, Lamport's logical clock, Vector clocks, Causal Order of messages, Birman-Schiper-Stephension protocol, Schiper-Eggli-Sandoz protocol, • Global state, Chandy Lamport snapshot algorithm, termination detection, Haung's algorithm	18	20
UNIT-III: **Distributed Mutual Exclusions**	• Requirements of Mutual Exclusion algorithms, Performance measurement metrics, Classification of mutual exclusion algorithm, Token based algorithms, Non-token based algorithm, Central Server Algorithm, Lamport's timestamp algorithm, Ricart-Agrawala Algorithm, Maekawa's Voting algorithm, Ring based algorithm, Suzuki-Kasami's Broadcast algorithm, Raymond's Tree-based algorithm • Election algorithms- the Bully algorithm, Ring algorithm. Mutual exclusion- definition, algorithms.	18	20
UNIT-IV: **Distributed Scheduling and Deadlock detection**	• Distributed scheduler, issues in distributed load distribution, components of load distribution algorithm, stability, task migration • Basic conditions of deadlocks, Resource and communication deadlock, Strategies of deadlock handling, issues in deadlock detection and resolution, Deadlock detection algorithms (Centralized, Distributed , Hierarchical)	9	10
UNIT-V: **Agreement Protocols and Inter-process Communication**	• System models, classification of agreement problems (Byzantine, Consensus, Interactive), Solutions to the Byzantine agreement problem,	9	10

	Applications of agreement algorithms • Inter-process Communications, API for UDP/TCP, Request Reply Protocol, Remote Procedure Call- basic RPC operation, parameter passing, examples. • Remote Object Invocation- distributed objects, integrating clients and objects, static versus dynamic RMI, parameter passing, examples and case study.		
UNIT-VI: **Naming**	• Naming entities- names, identifiers & addresses, name resolution, name space implementation, the Domain Name System.	4	5
UNIT-VII: **Distributed Transaction Processing**	• Distributed transactions- ACID properties, flat and nested transactions, atomic commit protocols, concurrency control in distributed transactions, Introduction, reasons for replication, object replication, consistency models	7	7
UNIT-VIII: **Distributed File Systems**	• Introduction: characteristics of file systems, distributed file system requirements, File service architecture, file accessing models, detailed case study of Sun Network File System (NFS).	7	8
	Total:	90	100

TEXTBOOKS/ RECOMMENDED READINGS:

- Tanenbaum & Steen; (2004); *Distributed Systems Principles and Paradigms*; Pearson Education
- Coulouris, Dollimore & Kindberg; (2006); *Distributed Systems Concepts and Design*; Pearson Education

COURSE ASSESSMENT DETAILS:

Internal assessment: Class tests, Assignments, Laboratory tests
External assessment: End Semester Examination

DEPARTMENT OF COMPUTER SCIENCE

Gopinath Bordoloi Nagar, Gauhati University

Guwahati-781014, Assam, India

LESSON PLAN

Subject Name : **Distributed System**

Paper Code : **CSC3026/INF3026** **Session:** **2018-2019**

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

Faculty Name : **Dwipen Laskar**

Date : **July, 2018 to December, 2018**

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

(**Dwipen Laskar**)
(Assistant Professor, Dept. of Computer Sc., GU)

COURSE CODE**: CSC2036**	L-T-P**: 4-1-1**
COURSE NAME**: SOFTWARE ENGINEERING**	CONTACT HOURS/WEEK**: 7**
COURSE TYPE**: CORE**	TOTAL MARKS**: 100 (**INTERNAL**: 60,** EXTERNAL**: 40)**
NUMBER OF CREDITS**: 6**	NATURE**: GRADED**

COURSE OBJECTIVES:

1. To provide students the knowledge of SE challenges, Software process, S/W development process model and problem analysis.
2. The give students the concepts of role of software architecture, architecture views, software cost estimation model, quality plan, and risk management.
3. To familiarize students with concepts of module level concept, OO Analysis and OO Design, UML, Coding process, refactoring, verification, testing fundamentals.

COURSE PREREQUISITE:

- Basic knowledge of database management system.

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Compare different software development processes and their challenges.
- Create software require specification and translate it into an implementable design, following a structured and organize process.
- Implement different software estimation metrics such as cost, effort size, staffing etc.
- Make effective use of UML, along with design strategies such as defining software architecture, separation of concerns and design patterns.

COURSE CONTENT:

Unit No & Name	Components of the Unit	No of contact hours	Marks
UNIT-I: **Software challenges and Software process**	• Problem domain, SE challenges • SE approach. Software process, Characteristics of SW process, SW development process model.	10	10
UNIT-II: **Software requirement and specification**	• SW requirement, problem analysis, requirement specification. • Functional specification, validation, matrices.	10	15

UNITIII:**Software architecture views and cost estimation model.**	• Role of SW architecture, architecture view, component and connector view, style for C&C view. • Process planning, Effort estimation, Software Cost Estimation based on COCOMO II cost model. • Scheduling and staffing. • SW configuration management plan, quality plan, risk management, project monitoring plan.	30	35
UNIT-IV: **Design principles and Methodology**	• Design principle • Module level concept • Design notation and specification, • Structured design methodology verification. • OO Analysis and OO Design. OO Design concept, UML. OO Design methodology.	25	25
UNIT-V: **Detail Design and Testing fundamentals**	• Detail design and PDL • Verification, Metrices, Programming principles and guidelines, coding process, refactoring, verification. Testing fundamentals.	15	15
	Total	90	100

TEXTBOOKS/ RECOMMENDED READINGS:

- Jalote P. ; *An integrated Approach to Software Engineering*; Narosa Publishing House
- Patton R.; *Software Engineering;* Pearson Education.
- Agarwal K. K., Singh Y,; *Software Engineering*; New Age International Publisher.
- Sommerville I.; *Software Engineering*; Pearson Education (Addison Wesley)
- Pressman R.S.; *Software Engineering: A practitioner's Approach*; McGraw Hill.

COURSE ASSESSMENT DETAILS:

Internal assessment: Class tests, Assignments, Laboratory tests
External assessment: End Semester Examination

DEPARTMENT OF COMPUTER SCIENCE

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LESSON PLAN

Subject Name : **Software Engineering**

Paper Code : **CSC2036/INF2036** **Session:** **2018-2019**

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

Faculty Name : **Dwipen Laskar**

Date : **Jan, 2019 to June, 2019**

Detailed Lesson Plan

UNIT-I (Software challenges and Software process)

Lecture No	Topics to be Covered
1	Problem domain: Software vs Program, Process vs Product, Exploratory Style of Programming
2	SE Challenges, Software Crisis, Software Process Model, SE approaches
3	Characteristics of SW process, Emergence of Software Engineering, Notable Changes in Software Development Practices
4	SW development process model: basic concepts, Build and Fix model, Waterfall model, Classical Waterfall Model
5	Iterative Waterfall Model, V-Model, Prototyping Model
6	Incremental Developmental Model, Evolutionary Model
7	Spiral Model, Agile Software Development, Comparison of Different Life Cycle Models

UNIT-II (Software requirement and specification)

13	SW requirement: Requirement Gathering and Analysis, Software Requirement Specification(SRS):-users of SRS, Characteristic of Good and bad SRS
14	Functional Specification: how to identify and Document, Functional Requirements, Traceability
15	Representation of complex logic in SRS, Decision Tree and Decision Table
16	Formal Technique
17	Axiomatic Specification, validation, matrices

UNIT-III (Software architecture views and cost estimation model)

18	Role of SW architecture, architecture view, component and connector view, style for C&C view.

19	Software Project Management Complexities, Responsibilities of SW Project Manager
20	Process planning, Software Planning, Sliding Window Planning
21	Software Size Estimation: LOC, Function Point Metric, Feature Point Metric
22	Empirical Estimation Techniques, Expert Judgment, Delphi Cost Estimations
23	Effort estimation,
24	Cost Estimation based on COCOMO: Basic, Intermediate and Complete COCOMO
25	Staffing Level Estimation: Norden's Work, Putnam's Work, Jensen's Model
26	Software Scheduling and staffing: Work Breakdown Structure, CPM,
27	Activity Network, PERT Charts, Gantt Chart
28	Organization Structure: Chief Programmer team, Democratic Team and Mix Team
29	Team Structure: Project Format, Functional Format, Matrix Format
30	Risk Management, Risk Identification, Types of Risks, Risk Abatement Policies
31	SW configuration management plan, Source Code Control System, RCS, Project monitoring plan.
32	Software Reliability, Hardware vs Software Reliability, Reliability Metrics
33	Reliability Growth Model, Statistical Testing, Quality plan: McCall's Quality factors, ISO9000
34	SEI Capability Maturity Model, Comparison of SEI/CMM and ISO 9000

UNIT-IV (Design principles and Methodology)

35	Design principle, Outcome of design process, classification of design activities and design methodologies
36	Characteristics of good design, Module level concept, Design notation and specification
37	Layered architecture of modules, Cohesion and Coupling
38	Overview of SA/SD, Structured Analysis (DFD)
39	Structured Analysis (DFD): Context Level Diagram, Types of DFDs, Notations of DFD, Data dictionary
40	Transformation of DFD into Structure Chart, Detailed Design
41	OO Analysis and OO Design: OO Design concept, Origin of UML, Evolution of UML, UML Diagrams
42	UML Diagrams: Use Case Diagram, Representation, Factoring, Use Case Packaging
43	UML Diagrams: Class Diagram, Object Diagram
44	UML Diagrams: Interactive Diagrams, State Chart Diagram, Deployment and Component Diagram

45	Programming principles and guidelines, coding process, Code Walkthrough, Code Inspection and Clean Room Testing, Software Documentation
46	Software Testing: basic concepts, Unit Testing, Integration and System Testing, Acceptance Testing
47	Black Box Testing-Equivalence Partitioning, Boundary Value Analysis
48	White Box Testing-Statement Coverage, Branch Coverage
49	Condition Coverage, Path Coverage, McCabe's Cyclomatic Complexity, Data Flow based Testing, Mutation Testing
50	Debugging Approaches, Guidelines, Program Analysis Tools: Static and Dynamic

UNIT-V (Detail Design and Testing fundamentals)

52	Detail design and Process Design Language (PDL)
53	Software Verification and Validation,
54	Code Refactoring concepts and Techniques
55	Integration Testing and System Testing: Smoke Testing, Performance Testing, Error Seeding
56	Software Maintenance: Reverse Engineering, Estimation of Maintenance Cost, CASE tools

(**Dwipen Laskar**)
(Assistant Professor, Dept. of Computer Sc., GU)