Fr. Conceicao Rodrigues College Of Engineering

Fr. Agnel Ashram, Bandra

Department of Computer Engineering

Course Outcomes & Assessment Plan

B.E. (Computer) (semester VIII)

Subject: Distributed Systems

Subject Code: CSC802

Academic Term: *Jan – May 2020*

Teacher:*Merly Thomas Puthiyadom*

Syllabus:

Module No.	Hrs	Topics	
1.0	**6**	Introduction to Distributed Systems	
		1.1 Characterization of Distributed Systems: Issues, Goals, and Types ofdistributed systems, Distributed System Models, Hardware concepts,Software Concept. 1.2 Middleware: Models of Middleware, Services offered by middleware,Client Server model.	10%
2.0	**10**	Communication	
		2.1 Layered Protocols, Interprocess communication (IPC): MPI, RemoteProcedure Call (RPC), Remote Object Invocation, Remote MethodInvocation (RMI) 2.2 Message Oriented Communication, Stream Oriented Communication,Group Communication.	15%
3.0	**10**	Synchronization	
		3.1 Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutualExclusion Algorithm, Requirements of Mutual Exclusion Algorithms,Performance measure. 3.2 Non Token based Algorithms: Lamport Algorithm, Ricart-Agrawala's Algorithm, Maekawa's Algorithm 3.3 Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms, Singhal's Heuristics Algorithm, Raymond's Tree Based Algorithm, Comparative Performance Analysis.	15%
4.0	**6**	Resource and Process Management	
		4.1 Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, 4.2 Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration	15%
5.0	**8**	Consistency, Replication and Fault Tolerance	
		5.1 Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Replica Management 5.2 Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery	15%
6.0	**12**	Distributed File Systems and Name Services	
		Introduction, good features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Network File System(NFS), Andrew File System(AFS), Hadoop Distributed File System and Map Reduce. Introduction to Name services and Domain Name System, Directory Services, Case Study: The Global Name Service, The X.500 Directory Service	15%
	52	**Total**	**100**

Course Learning Objectives:

The price/performance ratios offered by distribution in computing, and the concept of sharing resources globally, along with the steady improvements in networking technologies have made Distributed systems very attractive and highly popular. The fundamental concepts and design principles discussed in the course are applicable to a variety of systems especially WWW.

This course aims to:

1. To provide students with contemporary knowledge in distributed systems
2. To equip students with skills to analyze and design distributed applications.
3. To provide master skills to measure the performance of distributed synchronization algorithms

Prerequisites: **Operating Systems**
Computer Networks

Course Outcomes:

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

CSC802.1	Demonstrate knowledge of the basic elements and concepts related to distributed systems & technologies **(B2 – Comprehension)**
CSC802.2	Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.**(B3 – Application)**
CSC802.3	Analyze the various techniques used for clock synchronization and mutual exclusion**(B4 – Analysis)**
CSC802.4	Demonstrate the concepts of Resource and Process management, and Fault Tolerance techniques**(B3 – Application)**
CSC802.5	Assess the significance of Consistency and Replication Management models**(B4 – Analysis)**
CSC802.6	Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications. **(B4 – Analysis)**

Relationship of course outcomes with program outcomes: Indicate 1 (low importance), 2 (Moderate Importance) or 3 (High Importance) in respective mapping cell.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2									2
CO2	3		2	2	2							
CO3	3	2	2	2								
CO4	3		2	2								
CO5	3	3	2									
CO6	3	3		2								
Course	3	3	2	3	3							2

Justification of CO to PO mapping

CSC802.1	Demonstrate knowledge of the basic elements and concepts related to distributed systems & technologies	
	PO1	As an Engineering solution to some complex computational problems which is efficient and cost effective
	PO3	Design of System components to meet the specific needs
	PO12	Gain ability to be prepared for life-long learning in the broadest context of technological change
	Tools	Lectures, Presentations, Practical Sessions, Assignment I & IV
	Target	2.5
CSC802.2	Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.	
	PO1	Specialized solutions to some complex computational problems
	PO3	Design of System components or mini models to meet the specific needs

	PO4	Implementation of RPC, RMI and MPI
	PO5	Apply appropriate techniques and tools
	Tools	Lectures, Presentations, Practical Sessions
	Target	2.5
CSC802.3	Analyze the various techniques used for clock synchronization and mutual exclusion	
	PO1	An Engineering solution to some complex computational problems
	PO2	Formulate solutions considering the several design issues
	PO3	Design solutions by developing components and processes
	PO4	Experimental approach to design solutions and valid conclusions
	Tools	Lectures, Presentations, Practical Sessions, Seminars
	Target	2.5
CSC802.4	Demonstrate the concepts of Resource and Process management and Fault tolerant solutions	
	PO1	Specialized solutions to some complex computational problems
	PO3	Design of System components or mini models to meet the specific needs
	PO4	Apply appropriate techniques and tools for solutions
	Tools	Lectures, Presentations, Practical Sessions, Seminars
	Target	2.5
CSC802.5	Assess the significance of Consistency and Replication Management	
	PO1	An Engineering solution to some complex computational problems
	PO2	Formulate solutions considering the several design issues
	PO3	Design solutions by developing components and processes

	Tools	Lectures, Presentations, Practical Sessions, Seminars
	Target	2.5
CSC802.6	Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications	
	PO1	An Engineering solution to some complex computational problems
	PO2	Formulate solutions considering the several design issues
	PO3	Design solutions by developing components and processes
	Tools	Lectures, Presentations, Practical Sessions, Seminars
	Target	2.5

Program Specific Outcomes (PSOs)

Student will have an ability to

1. Apply fundamental computer science knowledge to address real world challenges/opportunities.
2. Design and implement computing systems of varying complexity in multidisciplinary scenarios that meet specified requirements with appropriate consideration to architectural, algorithmic and security aspects.

Modes of delivery

Most of the time is spent on teaching the principles of Distributed Computations.

Modes of Delivery	**Brief description of content delivered**	**Attained COs**	**Attained POs**
Class room lectures and Presentations	All modules	ALL	PO1, PO2, PO3, PO4, PO5, PO12
Lab Experiments	Modules 2-6	CO2, CO3, CO6	PO1, PO2, PO3, PO4, PO5
Students presentations	Module 3,6	CO5	PO1, PO10
Case Study	DCE, CORBA, HADOOP, NFS	CO6	

CO Assessment Tools:

Course Outcome	***Assessment Method***								
	Direct Method (80 %)								***Indirect Method (20%)***
	Unit Tests		Assignments				SEE	Laboratory Practical	Course exit survey
	1	2	1	2	3	4			
CO1	30%		30%				40%		100%
CO2	20%	20%		20%			40%		100%
CO3								100%	100%
CO4		30%			30%		40%		100%
CO5		30%				30%	40%		100%

Assignments:

Four assignments will be given on completion the modules as follows:

Assignment No.1	On completion of the 1st module
Assignment No.2	On completion of 2nd and 3rd module
Assignment No.3	On completion of the 4th module
Assignment No.4	On completion of 5th and 6th module

Rubrics for Assignment Grading:

Indicator				
Timeline (2)		More than one session late (0)	One sessions late (1)	On time (2)
Level of content (4)	Just Managed (1)	Major points are addressed minimally (2)	Only major topics are covered(3)	Most major and some minor criteria are included. Information is Adequate (4)
Reading and Understanding (4)	Just Managed (1)	Superficial at most (2)	Understood concepts but no related topics (3)	Understood concepts and related topics (4)

Laboratory Experiments

Total ten number of laboratory experiments will be performed in the practical session as per the time schedule in the time table.

List of Experiments:

Sr. No	Title of Experiments	
1.	Client/server using RPC/RMI.	
2.	Implementation of multi tread application	
3.	Inter-process communication	
4.	Group Communication	
5.	Load Balancing Algorithm.	
6.	Name Resolution protocol.	
7.	Election Algorithm.	
8.	Clock Synchronization algorithms.	
9.	Mutual Exclusion Algorithm.	
10.	Deadlock management in Distributed systems	
11.	Distributed File System	
12.	CORBA (Demo)	

Rubrics for Laboratory Experiment Grading:

Indicator				
Timeline (3)	More than two sessions late (0)	Two sessions late (1)	One sessions late (2)	On time (3)
Knowledge (4)	Not adequate (1)	Superficial at most (2)	Understood concepts but no related topics (3)	Understood concepts and working (4)
skill (3)	Just Managed (1)	Just Managed (1)	Few steps are not appropriate (2)	Structured and optimum performance (3)

Lecture Plan			
Class	***BE (Computer Engineering) Semester VIII***		
Academic term	**Jan – May 2020**		
Subject	***Distributed Systems***		
Subject Code	***CSC 802*** ***CSL 802***		
No of Students	***78***		
Periods (Hours) per week	***Lecture***	***4***	
	Practical	***2***	
	Tutorial	*--*	
Evaluation System		***Hours***	***Marks***
	Theory examination	3	80
	Internal Assessment	1+1	20
	Practical Examination	--	--
	Oral Examination	--	25
	Term work	--	25
	Total	--	150
Time Table ***(Theory)***	***Day***	***Time***	
	Tuesday	8.45 – 9.45 am	
	Wednesday	8.45 – 9.45 am	
	Thursday	9.45 – 10.45 am	
	Friday	1.30 – 2.30 pm	
(Practicals)	Tuesday	11 am – 1.00 pm (B Batch)	
	Tuesday	2.30 pm – 4.30 pm (C Batch)	
	Wednesday	11 am – 1.00 pm (D Batch)	
	Thursday	11 am – 1.00 pm (A Batch)	

Course Content and Lesson plan: **Distributed Computing**					
Module 1: **Introduction to Distributed Systems**					
01	**Lecture No.**	**Date**		**Topic**	**Remarks(If any)**
		Planned	**Actual**		
1.1	1	07/01/2020	07/01/2020	Characterization of Distributed Systems: Issues of distributed systems	
	2	08/01/2020	08/01/2020	Goals, and typesof distributed systems	
	3	09/01/2020	09/01/2020	Distributed System Models, Hardware concepts,	
1.2	4	14/01/2020	14/01/2020	Software Concept	
	5	15/01/2020	15/01/2020	Middleware: Models of Middleware	
	6	16/01/2020	16/01/2020	Services offered by middleware	
	7	16/01/2020		Client Server models	Student Seminars
Module 2 : **Communication**					
2.1	8	17/01/2020	17/01/2020	Layered Protocols, Interprocess communication (IPC)	
	9	21/01/2020	21/01/2020	Remote Procedure Call (RPC)	
	10	22/01/2020	22/01/2020	Remote Object Invocation, Remote Method Invocation (RMI)	
	11	23/01/2020	23/01/2020	MPI – Message Passing Interface	
	12	24/01/2020	23/01/2020	Message Types	
2.2	13	28/01/2020	28/01/2020	Message Oriented Communication	
	14	29/01/2020	29/01/2020	Stream Oriented Communication	
	15	30/01/2020	30/01/2020	Group Communication	
	16	31/01/2020	31/01/2020	Group Communication	

	17	04/02/2020	04/02/2020	DCE	Case Study
***Module 3:* Synchronization**					
3.1	18	05/02/2020	05/02/2020	Clock Synchronization, Logical Clocks	
	19	06/02/2020	06/02/2020	Election Algorithms, Mutual Exclusion	
	20	07/02/2020		Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithms	
	21	11/02/2020		Requirements of Mutual Exclusion Algorithms, Performance measure.	
3.2	22	12/02/2020		Non Token based Algorithms: Lamport Algorithm, Ricart-Agrawala's Algorithm, Maekawa's Algorithm	
	23	13/02/2020		Non Token based Algorithms: Comparative Performance Analysis	Seminar
3.3	24			Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms,	
	25	18/02/2020		Singhal's Heuristics Algorithm,Raymond's Tree Based Algorithm	
	26	25/02/2020		Token Based Algorithms:Comparative Performance Analysis	Seminar
					Unit Test 1
***Module 4:* Resource and Process Management**					
4.1	27	03/03/2020		Desirable Features of global Scheduling algorithm, Task assignment approach	
	28	04/03/2020		Load balancing approach	
	29	05/03/2020		Load sharing approach	
4.2	30	06/03/2020		Introduction to process management, process migration, ,	
	31	10/03/2020		Threads, Virtualization	

	32	11/03/2020		Clients, Servers, Code Migration	
Module 5: **Consistency, Replication and Fault Tolerance**					
	33	12/03/2020		Introduction to replication and consistency, Data-Centric Consistency Models, Replica Management	
	34	13/03/2020		Client-Centric Consistency Models, Replica Management	
	35	18/03/2020		Fault Tolerance: Introduction, Process resilience,	
	36	20/03/2020		Reliable client-server and group communication, Recovery	
Module 6: **Distributed File Systems and Name Services**					
	37	24/03/2020		Introduction, good features of DFS,	
	38	25/03/2020		File models, File Accessing models	
	39	26/03/2020		File-Caching Schemes, File Replication	
	40	27/03/2020		Network File System(NFS)	Case Study
	41	31/03/2020		Andrew File System(AFS),	
	42	01/04/2020		Hadoop Distributed File System and Map Reduce	Case Study
	43	02/04/2020		Introduction to Name services and Domain Name System, Directory Services	
	44	03/04/2020		The Global Name Service, The X.500 Directory Service	Case Study
	46	01/04/2020		AFS	Seminar
	47	02/04/2020		Hadoop	Seminar
	48	03/04/2020		CORBA	Seminar