DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE & Affiliated to Anna University, Chennai)
Re-Accredited by NAAC with 'A' Grade
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PERAMBALUR-621212, TAMILNADU, INDIA.
Website: www.dsengg.ac.in

COURSE PLAN

Name of the Faculty				
Designation/Department	AP/CSE			
Course Code/Name	P23CST22/ADVANCED OPERATING SYSTEMS			
Year/Department	I – M.E / CSE			
Credits Details	L: 3	T: 0	P:0	C: 3
Total Contact Hours Required	45 hours			

Syllabus:

UNIT I	**INTRODUCTION**	**No. Of Periods: 9**
Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Theoretical Foundations - inherent limitations of a distributed system – lamport's logical clocks – vector clocks – causal ordering of messages – global state – cuts of a distributed computation – termination detection. Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms – a comparative performance analysis.		
UNIT II	**DISTRIBUTED DEADLOCK DETECTION AND RESOURCE MANAGEMENT**	**No. Of Periods: 9**
Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.		
UNIT III	**DISTRIBUTED SHARED MEMORY AND SCHEDULING**	**No. Of Periods: 9**
Distributed shared memory-Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithms – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of checkpoints – synchronous and asynchronous checkpointing and recovery – check		

pointing for distributed database systems recovery in replicated distributed databases.		
UNIT IV	**DATA SECURITY**	**No. Of Periods: 9**
Protection and security -preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection. Data security – cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography – multiple encryption – authentication in distributed systems.		
UNIT V	**MULTIPROCESSOR AND DATABASE OPERATING SYSTEM**	**No. Of Periods: 9**
Multiprocessor operating systems - basic multiprocessor system architectures – interconnection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads process synchronization and scheduling. Database Operating systems :Introduction- requirements of a database operating system Concurrency control : theoretical aspects – introduction, database systems – a concurrency control model of database systems- the problem of concurrency control – serializability theory- distributed database systems, concurrency control algorithms – introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms – concurrency control algorithms: data replication		

Objective:

- To get a comprehensive knowledge of the architecture of distributed systems.
- To understand the deadlock and shared memory issues and their solutions in distributed environments.
- To know the security issues and protection mechanisms for distributed environments.
- To get a knowledge of multiprocessor operating systems and database operating systems.

Text Book:

- Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", McGraw Hill Education, 7th Edition, 2017.
- Andrew S.Tanenbaum, "Modern operating system", PHI, 4th Edition, 2007
- Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 1st Edition, 2003.
- Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 3rd Edition, 2003.

Website:

W1: Advanced operating system pdf - Advanced Operating System Notes and Study Material PDF Free Download - BTech Geeks

W2: Advanced Operating Systems Lecture Notes | PDF | Computer Cluster | Operating System

Online Mode of Study:

- Bing Videos

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I	**INTRODUCTION**					
1	Architectures of Distributed Systems	T1	1–10	BB	1	1
2	System Architecture Types	T1	11–20	BB	1	2
3	Issues in Distributed Operating Systems	T1	21–30	BB	1	3
4	Communication Networks	T1	31–40	BB	1	4
5	Communication Primitives	T1	41–50	BB	1	5
6	Theoretical Foundations & Limitations	T1	51–60	BB	1	6
7	Lamport's Logical Clocks & Vector Clocks	T1	61–70	BB	1	7
8	Causal Ordering, Global State & Cuts	T1	71–80	BB	1	8
9	Termination Detection & Distributed Mutual Exclusion (Intro & Classification)	T1	81–95	PPT	1	9
Outcome of Unit I: **CO1:** Understand and explore the working of Theoretical Foundations of OS.						
UNIT II	**DISTRIBUTED DEADLOCK DETECTION AND RESOURCE MANAGEMENT**					
10	Introduction to Distributed Deadlock Detection	T1	100–110	BB	1	10
11	Deadlock Handling Strategies in Distributed Systems	T1	111–120	BB	1	11
12	Issues in Deadlock Detection and Resolution	T1	121–130	BB	1	12
13	Control Organizations for Deadlock Detection	T1	131–140	BB	1	13
14	Centralized Deadlock Detection Algorithms	T1	141–150	BB	1	14
15	Distributed Deadlock Detection Algorithms	T1	151–160	BB	1	15
16	Hierarchical Deadlock Detection Algorithms	T1	161–170	BB	1	16
17	Agreement Protocols & Byzantine Problem	T1	171–185	BB	1	17

18	Distributed Resource Management & File Systems	T1	186–200	PPT	1	18
Outcome of Unit II: **CO2:** Analyze the working principles of Distributed Deadlock Detection and resource management						
UNIT III	**DISTRIBUTED SHARED MEMORY AND SCHEDULING**					
19	Distributed Shared Memory (DSM) – Architecture	T1	200–210	BB	1	19
20	Algorithms for Implementing DSM	T1	211–220	BB	1	20
21	Memory Coherence and Protocols	T1	221–230	BB	1	21
22	DSM Design Issues	T1	231–240	BB	1	22
23	Distributed Scheduling – Introduction & Load Distribution Issues	T1	241–250	BB	1	23
24	Components of Load Distributing Algorithm & Stability	T1	251–260	BB	1	24
25	Load Distributing Algorithms & Performance Comparison	T1	261–270	BB	1	25
26	Selection of Load Sharing Algorithm & Task Migration Issues	T1	271–280	BB	1	26
27	Failure Recovery & Fault Tolerance (Concepts, Checkpointing, Recovery)	T1	281–300	PPT	1	27
Outcome of Unit III: **CO3:** Understand the concepts of distributed shared memory and scheduling mechanisms						
UNIT IV	**DATA SECURITY**					
28	Protection and Security – Preliminaries	T1	300–310	BB	1	28
29	Access Matrix Model and Implementations	T1	311–320	BB	1	29
30	Safety in Access Matrix Model	T1	321–330	BB	1	30
31	Advanced Models of Protection	T1	331–340	BB	1	31
32	Cryptography Model	T1	341–350	BB	1	32
33	Conventional Cryptography	T1	351	BB	1	33

34	Modern Cryptography	T1	352	BB	1	34
35	Private Key Cryptography (DES)	T1	351–360	BB	1	35
36	Public Key Cryptography & Multiple Encryption	T1	361–370	BB	1	36

Outcome of Unit IV:

CO4: Understand and analyze the working of Data security.

UNIT V	**MULTIPROCESSOR AND DATABASE OPERATING SYSTEM**					
37	Multiprocessor System Architectures	T1	380–390	BB	1	36
38	Interconnection Networks for Multiprocessor Systems	T1	391–400	BB	1	37
39	Caching and Hypercube Architecture	T1	401–410	BB	1	38
40	Structure of Multiprocessor Operating Systems	T1	411–420	BB	1	39
41	OS Design Issues, Threads, Process Synchronization & Scheduling	T1	421–430	BB	1	40
42	Database Operating Systems – Introduction & Requirements	T1	431–440	BB	1	41
43	Concurrency Control – Concepts & Serializability Theory	T1	441–450	BB	1	42
44	Concurrency Control Algorithms (Lock, Timestamp, Optimistic)	T1	451–460	BB	1	43
45	Data Replication & Distributed Database Concurrency Control	T1	461–470	PPT	2	45

Outcome of Unit V:

CO5: Apply the learning into multiprocessor system architectures.

CO6: Understand concurrency control system in multiprocessor and database operating system.

Course Outcome:

On the completion of the course, the students will be able to

CO1: Understand and explore the working of Theoretical Foundations of OS.

CO2: Analyze the working principles of Distributed Deadlock Detection and resource management

CO3: Understand the concepts of distributed shared memory and scheduling mechanisms

CO4: Understand and analyze the working of Data security

CO5: Apply the learning into multiprocessor system architectures.

CO6: Understand concurrency control system in multiprocessor and database operating system.

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	-	-	-	-	-	-	-	1	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	2	2
CO3	2	3	2	2	2	-	-	-	1	-	-	1	3	2
CO4	2	2	1	2	2	2	-	2	-	-	-	1	2	2
CO5	3	2	3	2	3	-	-	-	1	-	-	1	3	3
CO6	3	3	2	3	2	-	-	-	1	-	-	2	3	3
AVG	2.7	2.5	1.7	2.0	1.7	0.3	0	0.3	0.5	0	0	1.2	2.5	2.2

Topic beyond Syllabus:

- Google Spanner & TrueTime (real-world distributed time synchronization)
- Resource Management in Cloud Environments
- GPU-based Parallel Processing
- Distributed Databases (NoSQL systems like MongoDB, Cassandra)

Internal Evaluation Components:

Webportal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
Webportal 1	--	Assessment – I (60)	Unit I and II	CO 1 & CO2
	1	Assignment – Handwritten (20)	1. Communication Networks(Topic No: 4) 2. Distributed Deadlock Detection Algorithms(Topic No:15)	CO 1 & CO2
	2	Assignment – Poster Presentation / PPT (20)	3. Lamport's Logical Clocks & Vector Clocks (Topic No:7) 4. Agreement Protocols & Byzantine Problem(Topic No:17)	CO 1 & CO2
Webportal 2	--	Assessment – II (60)	Unit III and IV	CO3 & CO4
	3	Seminar (20)	5.Distributed Shared Memory (DSM) – Architecture(Topic No:19) 6. Access Matrix Model and Implementations(Topic No:29	CO3 & CO4
	4	Case Study Report (20)	7. Selection of Load Sharing Algorithm & Task Migration Issues(Topic No:26) 8.Advanced Models of Protection(Topic No:29)	CO3 & CO4
Webportal 3	--	Model Exam (75)	Unit I to V	CO1 to CO6
	5	MCQ (15)	Unit I to V	CO1 to CO6
	-	Course Attendance (10)	--	--

Submission Details:

Phase 1(Before AT 1)		Phase 2 (Before AT 2)		Phase 3 (Model)
Assignment 1	Assignment 2	Assignment 3	Assignment 4	Assignment 5

PLAN OF ASSESSMENT TEST –DISTRIBUTION OF MARKS:

TEST	CO- MARK WISE DISTRIBUTION						BLOOM'S LEVEL MARK WISE DISTRIBUTION					
AT-1	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	37	23	-	-	-	-	-	-	-	-	-	-
AT-2	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	-	-	37	23	-	-	-	-	-	-	-	-
MODEL	CO1	CO2	CO3	CO4	CO5	CO6	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
	20	20	20	20	10	10	-	-	-	-	-	-

Prepared By **Verified By**

Approved By

PRINCIPAL