Lecture Plan -1

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :-Introduction to Distributed Systems	Time Allotted:-
1.	Introduction .Limitations of a Uniprocessor lead to development of the system of interconnected collection of autonomous computers. Advantages such as Economics Speed Reliability Incremental Growth Data Sharing Device Sharing Communication – email…etc Flexibility – utilize computers efficiently discussed. Disadvantages like Software – Not much exists, too complex Networking Security stated and expanded.	5 min.
2	Division of the Topic What is a Sequential (Uniprocessor System)? Definition of a Distributed System. Classification based on structure and behavior Advantages and Disadvantages of DS	35 min.
3.	Conclusion In this session you learnt numerous issues that are advantageous and disadvantageous in a distributed environment. A comparative study of centralized versus distributed system highlighted.	5 min 5 min.
4	Question / Answer What is a Distributed System? Solutions Distributed systems are a collection of CPUs that cooperate to make the system resemble a single computer	

Assignment to be given:-
Nill

Reference Readings:- Distributed Operating Systems: Prentice hall of India

Lecture Plan -2

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :-Goals of Distributed Systems	Time Allotted:-
1.	Introduction . Looking into the advantages and disadvantages of DS the Goals are defined. Issues raised Flexcibilty, transparency, security, scalability.	5 min.
2	Division of the Topic Goals Defined Discussion on Related Design Issues	35 min.
3.	Conclusion In this session you learnt numerous issues that are advantageous and disadvantageous in a distributed environment. A comparative study of centralized versus distributed system highlighted.	5 min 5 min.
4	Question / Answer Mention a few kinds of transparency Solution: Migration transparency Location Transparency Resource Transparency	

Assignment to be given:-
Nill

Reference Readings:- Distributed Operating Systems: Prentice hall of India

Lecture Plan -3

Faculty: :- Chitra Kaul Semester:-VII Class:-IT

Course Code:-CSE402 E

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :-Hardware and Software concepts	Time Allotted:-
1.	Introduction Hardware for multiple CPU systems: • multiprocessors o shared memory o bus-based or switched • multicomputers o no shared memory o bus-based or switched Software for multiple CPU systems: • Network operating systems o independent workstations with shared file system • Distributed operating systems o single-system image • Shared memory multiprocessor systems o not true distributed systems	5 min. 35 min.
2	Division of the Topic • Multiprocessors vs. multicomputers • Homogeneous vs. heterogeneous • Parallel computing vs. distributed	5 min
3.	Conclusion Defined the description and main goal for DS SoftWare Distributed Operating System Network operating System Middleware Comparison of the above three. Classified the hardware as Tightly Coupled/ Loosely Coupled.	5 min.

4	Question / Answer 1. What is the difference between a loosely coupled and a tightly coupled system? 2. What is the difference between a multicomputer and a multiprocessor? Solutions 1. Tightly coupled systems communicate on the order of CPU speed. Loosely coupled systems communicate at much lower rates than CPU speed. 2. A multicomputer has no shared memory. A multiprocessor has a shared memory directly accessible by each CPU.	

Assignment to be given:-

1. What distinguishes a MIMD computer from a SIMD one?

2. What is the difference between a network operating system and a distributed operating system?

3. What distinguishes a MIMD computer from a MISD one?

Reference Readings:- Distributed Operating Systems: Prentice hall of India

Lecture Plan -4

Faculty: :- Chitra Kaul Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :- Layered Protocols	Time Allotted:-
1.	Introduction • Emphasized on OSI (Open Systems Interconnection Reference Model). • Defined the connection oriented and connectionless protocols. • Defined the structure of a typical message as it appears on the network. • Discussed the operational features of each of the layers	5 min.
2	Division of the Topic • Physical Layer • Data Link Layer • Network Layer • Transport Layer • Session Layer • Presentation Layer • Application Layer	35 min.
3.	Conclusion In this session you learnt • physical layer is basically concerned with physical transmission of data in form of bits (0's and 1's) • Data link layer jumbles up the bits in frames and takes the responsibility of any error checks, • Network layer tracks the best routing path • Transport layer makes reliable connection by providing over lost data • Session layer deals with synchronization of packets • Presentation layer takes care of the format. • Application layer is the collection of all other layers.	5 min
4	Question / Answer What is meant by an open system? Solution: An open system is one that is prepared to communicate with any other open system by using standard rules that govern the format, contents and meaning of the messages sent and received.	5 min.

Assignment to be given:-Nill

Reference Readings:- NIIT Handbook, Java Handbook by Patrick Naughton.

Lecture Plan-5

Faculty: :- Chitra Kaul - Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :- ATM Networks	Time Allotted:-
1.	Introduction The ATM Model is that a sender first establishes a connection to receiver/s; a route is established that is stored by the switches all along the way. Data is fragmented into fixed sized Cells. ---ATM Layers Physical Layer ATM layer Adaptation Layer Upper Layers	5 min.
2	Division of the Topic • What is Asynchronous Transfer Mode? • The Various Layers • ATM switching • Implications of ATM for DS	35 min.
3.	Conclusion In this session you learnt ATM is advantageous over both circuit switching and packet switching as it can handle both the multicasting and point-to-point efficiently.	5 min
4	Question / Answer Give the layout of the ATM cell header Solution: GFC—Generic Flow Control VPI---Virtual path Identifier VCI---Virtual channel identifier CLP---Cell Loss Priority CRC---Cyclic Redundancy Checksum	5 min.

Assignment to be given:-
Nill

Reference Readings:- NIIT Handbook, Java Handbook by Patrick Naughton.

Lecture Plan -6

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :- Client-Server Model	Time Allotted:-
1.	Introduction The client-server model is based on connectionless request/reply protocol.The client sends a request message to the server asking for some service. The server does the work and returns the data requested.	5 min.
2	Division of the Topic • Define Client and Server • Addressing Mode In Client Server Model • Blocking versus Non Blocking Primitives • Buffered versus Unbuffered Primitives • Reliable versus Unreliable Primitives • Implementing the Client-Server Model	35 min.
3.	Conclusion The major advantage of Client Server is it's simplicity and efficiency. Also the advantages and disadvantages of various primitives summed down.	5 min
4	Question / Answer What is Blocking and Non-blocking primitive? Solutions While the message is being sent, the sending process is blocked or suspended. The instruction following the call to send is not executed until the message has been completely sent. Whereas if send is non blocking it returns control to the caller immediately, before the message is sent. The sending process can continue computing in parallel with message transmission.	5 min.

Assignment to be given:-
Nill

Reference Readings:- NIIT Handbook, Java Handbook by Patrick Naughton.

Lecture Plan -7

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :- Remote Procedure Call	Time Allotted:-
1.	Introduction The problem with client-server model was the Input/Ouput. I/O was the major cause of flaw. RPC (Remote Procedure Call) serves the purpose. When a process on machine A calls a procedure on machine B, the calling process on machine A is suspended, and execution of the called procedure takes place on machine B. Information can be transferred from the caller to the callee in the parameters and can come back in the procedure result. No message passing or I/O is at all visible to the programmer.	5 min.
2	Division of the Topic • Defining RPC • Basic RPC Operation • Parameter Passing • Dynamic Binding • RPC Semantics in presence of Failures • Implementation Issues	35 min.
3.	Conclusion In this session you learnt that while the basic idea sounds simple and elegant, subtle problems exist. To start with, because the calling and called procedures run on different machines, they execute in different address spaces, which causes complications. Parameters and results also have to be passed, which can be complicated, especially if the machines are not identical. Finally, both machines can crash and each of tge possible failures causes different problems. RPC provides ways to deal with these problems	5 min
4	Question / Answer State the possible failure conditions. Solution: Client cannot locate server. Lost request messages Lost reply messages Server crashes Client crashes	5 min.

Assignment to be given:-
Nill

Reference Readings:- NIIT Handbook, Java Handbook by Patrick Naughton.

Lecture Plan -8

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-I

S. No.	Topic :- Group Communication	Time Allotted:-
1.	Introduction A group is a collection of processes that act together in some system or user-specified way. The key property that all groups have is that when a message is sent to the group itself, all members of the group receive it. Communication works on the techniques of multicast or broadcast.	5 min.
2	Division of the Topic • Introduction to Group communication • Design Issues • Closed versus Open Groups • Peer versus Hierarchical Groups • Group membership • Group Addressing • Send and Receive Primitives • Atomicity • Message Ordering • Overlapping Groups • Scalability • Middleware and Distributed Operating syatems	35 min.
3.	Conclusion In this session you learnt the various issues connected to group communication. Groups are Dynamic. New groups can be added and old groups can be destroyed. A process can join a group or leave one. A process can be a member of several groups at the same time. Mechanisms needed for managing groups and group membership discussed.	5 min
4	Question / Answer What is a closed group and open group? Solution Closed Group---Where only members of the group can communicate Open Group---Any process in the system can send to any group.	5 min.

Assignment to be given:-
How can atomic broadcast be used to manage group membership?

Reference Readings:- Distributed Systems: .Principles and Paradigms

Lecture Plan-9

Faculty:- :- Chitra Kaul Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :- Concept of Synchronization	Time Allotted:-
1.	Introduction Distributed systems have in general the following properties: • The relevant information is scattered among multiple machines. • Processes make decisions based on local information • A single point of failure in the system should be avoided • No common clock or other Global time source exists. Because of the above factors several issues are raised such as Deadlock Free Resource Allocation Having a single point of failure makes it unreliable. In a centralized system time is unambiguous.	5 min.
2	Division of the Topic • Clock Synchronization • Physical Clocks • Logical Clocks	35 min.
3.	Conclusion In this session you learnt how do we synchronize with real world clocks and how do we synchronize the clocks with each other.	5 min
4	Question / Answer What is a physical Clock and logical clock? Solution: When the clocks must be internally consistent, not whether they are particularly close to real time then it is a logical clock. When the clock must not deviate from the real time by a certain amount it's aphysical clock.	5 min.

Assignment to be given:-
Nill

Reference Readings:- Distributed Systems: .Principles and Paradigms

Lecture Plan -10

Semester:-VII Class:-IT

Course Code:-CSE-402-E

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Mutual Exclusion	Time Allotted:-
1.	Introduction Lamport's Algorithm -- Properties this algorithm requires a total ordering of events, all sites to be alive, requires 3(N 1) messages per request, response time in a very low load, T: per message communication latency, assume there is no one in CS, send N 1 request messages sent in parallel (T), send N 1 response messages sent in parallel (T), so, requester enters CS after 2T time Ricart-Agrawala's Algorithm this algorithm requires a total ordering of events, require all sites to be alive, requires 2(N 1) messages per request, response time in a very low load, send N 1 request messages in parallel (T), send N 1 response messages in parallel (T) , Token Ring Algorithm -- Properties simple and no deadlock or starvation, number of messages and response time, if only one node needs the token, the token will traverse N/2 nodes on average, best case: 0 message (the node has the token) 0 delay, worst case: N 1 messages (sequentially) (N 1)T delay, tolerable overhead with small N, cannot scale up for large N, it is difficult to design a fault tolerant algorithm for this scheme. The concept of token is similar to centralized control, however, the central site is moving.	5 min.
2	Division of the Topic • Centralized Algorithm • Distributed Algorithm • Token Ring Algorithm	35 min.
3.	Conclusion In this session you made a comparative study of the performance given by distributed systems in all the above mentioned cases.	5 min
4	Question / Answer Name one algorithm that cannot lead to the state of starvation? Solution: Token Ring.	5 min

Assignment to be given:-
Nill
Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -11

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Mutual Exclusion	Time Allotted:-
1.	Introduction Mutual Exclusion To guarantee consistency among distributed processes that are accessing shared memory, it is necessary to provide mutual exclusion when accessing a critical section. Assume n processes. A Centralized Algorithm for Mutual Exclusion Assume a coordinator has been elected. A process sends a message to the coordinator requesting permission to enter a critical section. If no other process is in the critical section, permission is granted. If another process then asks permission to enter the same critical region, the coordinator does not reply (Or, it sends "permission denied") and queues the request. When a process exits the critical section, it sends a message to the coordinator. The coordinator takes first entry off the queue and sends that process a message granting permission to enter the critical section. A Distributed Algorithm for Mutual Exclusion Ricart and Agrawala algorithm (1981) assumes there is a mechanism for "totally ordering of all events" in the system (e.g. Lamport's algorithm) and a reliable message system.A process wanting to enter critical sections (cs) sends a message with (cs name, process id, current time) to all processes (including itself).When a process receives a cs request from another process, it reacts based on its current state with respect to the cs requested. A Token Ring Algorithm An unordered group of processes on a network. A logical ring constructed in software.A process must have token to enter.	5 min.
2	Division of the Topic • Centralized Algorithm • Distributed Algorithm • Token Ring Algorithm	35 min.
3.	Conclusion In this session you made a comparative study of the performance given by distributed systems in all the above mentioned cases.	5 min 5 min.

4	Question / Answer Name one algorithm that cannot lead to the state of starvation? Solution: Token Ring.	

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan-12

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Election Algorithm	Time Allotted:-
1.	Introduction Election Algorithms Many distributed algorithms such as mutual exclusion and deadlock detection require a coordinator process. When the coordinator process fails, the distributed group of processes must execute an election algorithm to determine a new coordinator process. These algorithms will assume that each active process has a unique priority id.	5 min.
2	Division of the Topic Discussed the previous concepts of centralized and decentralized algorithms Discussed the election algorithm Discussed the advantages	35 min.
3.	Conclusion In this session you learnt how the distributed environment can enhance it's reliability by electing it's new coordinator in the presence of failures.	5 min
4	Question / Answer In election algorithm who is the coordinator? Solution: Process with the highest number.	5 min.

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -13

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Bully Algorithm	Time Allotted:-
1.	Introduction The Bully Algorithm • When any process, P, notices that the coordinator is no longer responding it initiates an election: • P sends an election message to all processes with higher id numbers. • If no one responds, P wins the election and becomes coordinator. • If a higher process responds, it takes over. Process P's job is done. • At any moment, a process can receive an election message from one of its lower-numbered colleagues. • The receiver sends an OK back to the sender and conducts its own election. • Eventually only the bully process remains. The bully announces victory to all processes in the distributed group. Bully Algorithm Example • Process 4 notices 7 down. • Process 4 holds an election. • Process 5 and 6 respond, telling 4 to stop. • Now 5 and 6 each hold an election. • Process 6 tells process 5 to stop. • Process 6 (the bully) wins and tells everyone. • If processes 7 comes up, starts elections again..	5 min.
2	Division of the Topic Discussed the previous concepts of centralized and decentralized algorithms Discussed the bully algorithm along with example. Discussed the advantages	35 min.
3.	Conclusion In this session you learnt how the distributed environment can enhance it's reliability by bully electing it's new coordinator in the presence of failures.	5 min 5 min.

4	Question / Answer Why is it called Bully algorithm Solution: During election if the process that was previously down comes back and if it holds the highest number it will win. Hence the biggest guy in the town is the bully.	

Assignment to be given:-
NIll

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -14

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Ring Algorithm	Time Allotted:-
1.	Introduction A Ring Algorithm Assume the processes are logically ordered in a ring {implies a successor pointer and an active process list} that is unidirectional. When any process, P, notices that the coordinator is no longer responding it initiates an election: 1. P sends message containing P's process id to the next available successor. 2. At each active process, the receiving process adds its process number to the list of processes in the message and forwards it to its successor. 3. Eventually, the message gets back to the sender. 4. The initial sender sends out a second message letting everyone know who the coordinator is {the process with the highest number} and indicating the current members of the active list of processes. Even if two ELECTIONS start at once, everyone will pick the same leader	5 min.
2	Division of the Topic Discussed the previous concepts of centralized and decentralized algorithms Discussed the ring algorithm along with example. Discussed the advantages	35 min.
3.	Conclusion In this session you learnt how the distributed environment can enhance it's reliability by ring election	5 min 5 min.

4	Question / Answer Do you use tokens in the ring algorithm Solution No.	

Assignment to be given:-
Nill
Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -15

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Atomic Transactions	Time Allotted:-
1.	Introduction The Transaction Model If a transaction involves multiple actions or operates on multiple resources in a sequence, the transaction by definition is a single, atomic action. Namely, It all happens, or none of it happens. Transaction Primitives Description : Primitive Write data to a file, a table, or otherwise : WRITE Read data from a file, a table, or otherwise : READ Kill the transaction and restore the old values :ABORT_TRANSACTION Terminate the transaction and try to commit : END_TRANSACTION Make the start of a transaction : BEGIN_TRANSACTION Transaction Properties [ACID] Atomic: transactions are indivisible to the outside world. Consistent: system invariants are not violated. Isolated: concurrent transactions do not interfere with each other. {serializable} Durability: once a transaction commits, the changes are permanent. {requires a distributed commit mechanism} Classification of Transactions Flat Transactions {satisfy ACID properties} Limited – partial results cannot be committed. Distributed and Nested Transactions	5 min. 35 min.
2	Division of the Topic Transaction Model Example of Atomic Transaction Primitives of Transaction Transaction Properties Classification of Transaction	5 min
3.	Conclusion In this session you learnt how to make a transaction consistent and updated by applying various concurrency control methods.	5 min.

4	Question / Answer What is a write-ahead log? Solution In this a record information is stored about which files are actually modified, which transaction is making the change and what are the new and old values.	

Assignment to be given:-
Nill
Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan-16

Semester:-VII Class:-IT
Course Code:-CSE-402-E
Subject:-Distributed Operating Systems Unit:-II

S. No.	Topic :-Deadlocks	Time Allotted:-
1.	Introduction Deadlock detection the basic approach is similar to deadlock detection in single processor systems basically, analyze whether there is a cycle in the wait for graph in distributed systems, the wait for graph is not on any single processor need different algorithms to simulate the analysis Deadlock avoidance impractical in single processor systems impractical in distributed systems Deadlock prevention linear ordering for static resources resources to be accessed are known in advance ordering accesses by timestamps	5 min.
2	Division of the Topic Deadlock Detection Deadlock Prevention Avoidance	35 min.
3.	Conclusion In this session you learnt what are deadlocks, How can they be avoided. Also the algorithms to detect and prevent deadlocks have been considered with various problems that can arise.	5 min
4	Question / Answer What is a resource deadlock? Solution A resource deadlock occurs when processes are fighting over exclusive access to I/O devices, files, locks etc.	5 min

Assignment to be given:- Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -17

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-III

S. No.	Topic :-Processes and Threads	Time Allotted:-
1.	Introduction Threads Idea – we build virtual processors in software Processor, threads and processes Context switch Process and thread context Observations Threads shared the same address space Process switching involves getting the OS in the loop Creating and destroying threads is cheaper than doing so with processes Threads and the OS User or kernel threads? Two level threading and scheduler activations Workstation Processor Pool	5 min.
2	Division of the Topic Introduction to Threads Thread Usage Design Issues for thread package Implementing thread package Scheduler Activations System models	35 min.
3.	Conclusion In this session you learnt what is a thread, the various thread models and it's implementation in the kernel or the user program.	5 min
4	Question / Answer Name the three models of threads. Solution Dispatcher/Worker Team model Pipeline model	5 min.

Assignment to be given:- Explain the three models of threads in detail. Also give it's implementation
Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan-18

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-III

S. No.	Topic :-Processor Allocation	Time Allotted:-
1.	Introduction Processor allocation: It determines where a process is to be run Scheduling: It determines when to run a process Migration: It determines whether to move a process to another machine Structure Models: The basic assumption about distributed system Policies: The overall policy that guides the management decisions Mechanisms: The facilities that allow management decisions to be implemented Processor allocation algorithms • The central algorithm • The up-down algorithm • The logical hierarchy algorithm • The logical ring algorithm • A sender-initiated algorithm • A receiver-initiated algorithm	5 min.
2	Division of the Topic Allocation models Design Issues Implementation Issues	35 min.
3.	Conclusion Processor Allocation Policy The transfer policy: To determine whether or not some processes should be executed remotely The selection policy: To determine which process should be transferred if some processes should be transferred The location policy: To determine which computer that a selected process should be transferred to Strategies on Migration Non-migratory When a process is created, a decision is made about where to put it. Once placed on a machine, the process stays there until it terminates Migratory A process can be moved from one machine to another, even if it has already started execution Migratory strategy allows better load balance, but it is very complex and has a major impact on system design.	5 min 5 min.

4	Question / Answer What Is Process Management ? Solution: Process management is the management of processing resources to improve system performance and usage.	

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -19

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-III

S. No.	Topic :-Scheduling in Distributed Systems	Time Allotted:-
1.	Introduction Each processor does its own local scheduling without regard that what the other processors do.	5 min.
2	Division of the Topic How scheduling done when two jobs are out of phase	35 min.
3.	Conclusion In this we studied how two jobs are running out of phase with each other.in this also Each processor does its own local scheduling without regard that what the other processors do.	5 min
4	Question / Answer What Is Co-Scheduling Solution: Inter process communication while scheduling to ensure that all the members are of a group run at the same time.	5 min.

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -20

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-III

S. No.	Topic :-Real-Time System	Time Allotted:-
1.	Introduction Two Types: Soft Real Time Hard Real Time Event triggered systems are interrupt driven whereas time trigerred sample the external devices. Real time communication must use predictable protocols. Both dynamic and static scheduling of tasks is possible.	5 min.
2	Division of the Topic Types of real time systems Design Issues Real time communication Real time scheduling	35 min.
3.	Conclusion Real-time systems are loosely defined as the class of computer systems that interact with the external world in a time frame defined by the external world. Aim is on the use of proportional share resource allocation technology for providing real-time services in general purpose operating systems and on the use of wait-free and lock-free synchronization technology for accessing shared objects in real-time	5 min
4	Question / Answer Give the parameters that characterize the real time scheduling. Solution: Hard real time vs soft real time Preemptive vs nonpreemptive Dynamic vs static Centralized vs decentralized	5 min.

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -21

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-IV

S. No.	Topic :-Distributed File Systems	Time Allotted:-
1.	Introduction In a distributed file system the storage is distributed over the network. The failure of a few sites does not cause a disaster because there are always some sites still working well. Thus, if we replicate a file and distribute the copies over the network, the availability of the file is significantly enhanced. Although fault tolerance is the nature of distributed systems, whether it can be used depends on the facilities provided by their file mechanisms. Such facilities must replicate the file and maintain the consistency of each copy automatically. Many researchers have been working on that, but their approaches are different. 6	5 min.
2	Division of the Topic Design: File Server Interface Directory Server Interface Semantics of file sharing Implementation: File usage Caching Replication Trends in Distributed file systems	35 min.
3.	Conclusion In this session you learnt various semantic models , session semantics, immutable files and transaction semantics	5 min
4	Question / Answer What is cache? Solution: A high-speed storage mechanism, in either a section of the main memory or an independent high-speed storage device.	5 min.

Assignment to be given:-
Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -22

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-IV

S. No.	Topic :-Shared Memory	Time Allotted:-
1.	Introduction DSS Features: • provides distributed,random access byte blocks (chunks) • replication/fault-tolerance • strict coherency operations • relaxed coherency operations • multiple store options (making Windows 95 port possible	5 min.
2	Division of the Topic Definition Comparison of various models Consistency models Types of consistency	35 min.
3.	Conclusion Summary of consistency models: Strict:Absolute time ordering of all shared accesses matters Sequential: All processes see all share accesses in the same order. Casual: All processes see all casual shared in the same order. Processor: PRAM consistency + memory coherence PRAM: All processes see writes from each processor in the order they were issued.	5 min
4	Question / Answer Expand PRAM. Solution Pipelined RAM	5 min.

Assignment to be given:- Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -23

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-IV

S. No.	Topic :-Page Based Distributed Shared Memory	Time Allotted:-
1.	Introduction **Basic Design** The idea behind DSM is simple: **Try to emulate the cache of a multiprocessor using the MMU and operating system software** In a DSM system, the address space is divided up into **chunks**, with the chunks being spread over all the processors in the system. When a processor references an address that is not local, a trap occurs, and the DSM software fetches the chunk containing the address and restarts the faulting instruction, which now completes successfully.	5 min.
2	Division of the Topic Basic Design Replication Granularity Sequential consistency Page replacement	35 min.
3.	Conclusion Gives each process a linear paged memory. Pages are moved back and forth between machines as needed..	5 min 5 min.
4	Question / Answer Expand NORMA Solution NO Remote Memory Access	

Assignment to be given:- Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan -24

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-IV

S. No.	Topic :-Shared Variables distributed shared Memory	Time Allotted:-
1.	Introduction . Using shared variables that are individually managed also provides considerable opportunity to eliminate false sharing. If it is possible to update one variable without affecting other variables, then the physical layout of the variables on the pages is less important. The most important example of such system is **Munin**.	5 min.
2	Division of the Topic Munin Midway	35 min.
3.	Conclusion Page based takes a normal linear address space and allows the pages to migrate dynamically over the network on demand. A more structured approach is to share only certain variables and data structures that are needed by more than one process. In this way, the problem changes from how to do paging over the network to how to maintain a potentially replicated, distributed data base consisting of the shared variables. Different techniques are applicable here, and these often lead to major performance improvements	5 min
4	Question / Answer Solution Munin uses multiple protocols and release consistency to allow individual variables to be shared. Linda represents the other end of spectrum, with an abstract tuple space far removed from the details of paging.	5 min.

Assignment to be given:- Nill

Reference Readings:- *Distributed Systems : Principles and Paradigms*

Lecture Plan-25

Semester:-VII Class:-IT

Course Code:-CSE-402 F

Subject:-Distributed Operating Systems Unit:-V

S. No.	Topic :-Case study:MACH	Time Allotted:-
1.	Introduction Mach is a microkernel based operating system. It was designed as a base for building new OS and emulating existing ones. It also provides a flexible wa to extend UNIX to multiprocessors and distributed systems.	5 min.
2	Division of the Topic Goals Of MACH Mach MicroKernel Process Management Communication in MACH Emulation in MACH	35 min.
3.	Conclusion Mach is based on the concepts of processs, threads, ports and messages.	5 min
4	Question / Answer In Mach, Communication is based on _____ Solution Ports	5 min.

Assignment to be given:- Nill

.

Reference Readings:- *Distributed Systems : Principles and Paradigms*