AMITY UNIVERSITY
UTTAR PRADESH

Course Title: DISTRIBUTED OPERATING SYSTEM

Credit Units:

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	-	-	-	3

Course Level: PG
Course Code: IT611

Course Objectives:
This Subject provides students with an in-depth knowledge about the operating system. The former treats the standard principles of single processor system, including processes, synchronization, I/O, deadlocks, Memory Management, File Management systems, security and so on. This subject covers distributed operating system in detail, including communication process, file system and memory management synchronization and so on but this time in the context of distributed systems.

Pre-requisites:
Students are expected to know and understand the fundamentals of operating systems as taught in an undergraduate course using a text such as Operating System Concepts by Silberschatz& Galvin. Topics covered should include design and implementation of operating systems, file systems, and distributed operating systems. Students are also expected to be able to program in both Java and C/C++ in a UNIX environment.

Course Contents/Syllabus:

	Weightage (%)
Module I	**20**
Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating System, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture	
Module II	**20**
The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.	
Module III	**20**
Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamport's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms, Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.	
Module IV	**20**
Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.	

Module V	**20**
File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, Swift, Globus, Condor, Amazon AWS, OpenStack, Cilk, gdb, threads, MPICH, OpenMP, Hadoop, FUSE), Case studies.	

Student Learning Outcomes:

1. Knowledge and understanding
    a. Outline the potential benefits of distributed systems
    b. Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security
2. Cognitive skills (thinking and analysis).
    a. Apply standard design principles in the construction of these systems
    b. Select appropriate approaches for building a range of distributed systems, including some that employ middleware
3. Communication skills (personal and academic).
4. Practical and subject specific skills (Transferable Skills).

Pedagogy for Course Delivery:

The course would be covered under theory. In addition to assigning project–based learning, early exposure to hands-on design to enhance the motivation among the students. It incorporates designing of problems, analysis of solutions submitted by the students groups and how learning objectives were achieved. Continuous evaluation of the students would be covered under quiz, viva etc.

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**Total**
100%	NA	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					**End Term Examination**
Components (Drop down)	Mid-Term Exam	HA	Viva	Attendance	
Weightage (%)	10%	8%	7%	5%	70%

Text Reading:

- M. Beck et al Linux Kernel, Internal Addition Wesley, 1997.
- B.W. Kernighan and R Pide, the UNIX Programming Environment Prentice Hall of India-2000.
- Asilberschatz P.B Garvin Operating System Concept, John Wiley & Sons (Asia) Pte 2000.
- Cox K, "Red Hat Linux Administrator's Guide". PHI (200).

References:

- T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN 0-8186-3032-9

- R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, Addison-Wesley (1997) ISBN 0-201-49838-3
- G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN 0-201-61918-0
- D. L. Galli, Distributed Operating Systems, Prentice-Hall (2000) ISBN 0-13-079843-6
- C. Leopold, Parallel and Distributed Computing, John Wiley & Sons (2001) ISBN 0-471-35831-2
- G. J. Nutt, Centralized and Distributed Operating Systems, Prentice-Hall (1992) ISBN 0-201-61251-8
- M. Raynal, M. Beeson, trans., Algorithms for Mutual Exclusion, MIT Press (1986) ISBN 0-262-18119-3
- M. Raynal, J. Howlett, trans., Distributed Algorithms and Protocols, J. Howlett, trans., Wiley & Sons (1988) ISBN 0-471-91754-0
- M. Raynal, M. Sanders, trans., Networks and Distributed Computation, MIT Press (1988) ISBN 0-262-18130-4
- M. Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill (1994) ISBN 0-07-057572-X
- P. K. Sinha, Distributed Operating Systems: Concepts and Design, IEEE Press (1997) ISBN 0-7803-1119-1
- A. S. Tanenbaum, Distributed Operating Systems, Prentice-Hall (1995) ISBN 0-13-219908-4.