MCE 505: **DISTRIBUTED SYSTEMS** (3-0-0)

Module-I (12 hours)
Distributed systems: Definition, goals, types of Distributed Systems, Architectures, Key characteristics-resource sharing openness, concurrency, scalability, fault tolerance, transparency; Design issues, naming, communication, software structure, workload allocation, consistency maintenance; User requirement, functionality, Quality of service, reconfigurability; Interprocess communication, building blocks, client server communication; CORBA's Common Data Representation (CDR); Java object serialization; Extensible markup language (XML); Remote object references; Inter-process communication in UNIX; Remote procedure calling; Design issues, interface definition language exception handling; Implementation - interface processing, communication handling; Binding, Case study: sun RPC Vs. Java RMI.

Module-II (12 hours)
Distributed Operating systems: kernel, processes and threads, Naming and protection - Communication and Invocation, virtual memory, Distributed file services - design issues, interfaces, implementation techniques, Case study sun NFS, Name services: Name spaces; Name resolution, Domain Name System, SNS and DNS, Peer-to-Peer Systems. Coordination and Agreement: Time and Global States, Time and co-ordination, Synchronizing physical clocks- logical time and logical clocks, Distributed co-ordination, distributed mutual exclusion, elections, Replication, basic architectural model, consistency and request ordering.

Module-III (12 hours)
Distributed Transactions, Recovery and fault tolerances: Transaction recovery, logging - shadow versions, fault model for transaction; Fault tolerance: characteristics; Hierarchical and group masking of faults; Security, authentication and key distribution, logic of authentication, digital signatures; Web Services: SOAP, XML, CORBA, Distributed object based systems, Distributed file systems, Distributed web- based systems, Distributed co-ordination based systems.

Text Books:
1. George **Coulouris**, Jean **Dollimore** and Tim **Kindberg**, "*Distributed Systems: Concepts and Design*", Fourth Edition, 2006, Pearson Education, Inc. New Delhi.
2. Andrew S. **Tanenbaum**, Maarten **van Steen**, "*Distributed Systems: Principles and Paradigms*", 2nd Edition, 2007, PHI Learning Pvt. Ltd., New Delhi.

Reference Texts:
1. Hagit **Attiya**, Jennifer **Welch**, "*Distributed Computing: Fundamentals, Simulations, and Advanced Topics*", 2nd Edition, 2005, Wiley India Pvt. Ltd., New Delhi.
2. Mordechai **Ben-Ari**, "*Principles of Concurrent and Distributed Programming*", 2nd Edition, 2006, Pearson Education, Inc. New Delhi.
3. Mei-Ling **Liu**, "*Distributed Computing: Principles and Applications*", 2004, Pearson Education, Inc. New Delhi.
4. Gerard **Tel**, "*Introduction to Distributed Algorithms*", Second edition, 2002, Cambridge University Press / Foundation Books India, New Delhi.
5. Ajay D. **Kshemkalyani**, Mukesh **Singhal**, "*Distributed Computing: Principles, Algorithms, and Systems*", 2008, Cambridge University Press / Foundation Books India, New Delhi.