

CS701

DISTRIBUTED SYSTEMS AND ALGORITHMS

3-0-0-6

Basic concepts. Models of computation: shared memory and message passing systems, synchronous and asynchronous systems. Logical time and event ordering. Global state and snapshot algorithms, mutual exclusion, clock synchronization, leader election, deadlock detection, termination detection, spanning tree construction. Programming models: remote procedure calls, distributed shared memory. Fault tolerance and recovery: basic concepts, fault models, agreement problems and its applications, commit protocols, voting protocols, checkpointing and recovery, reliable communication. Security and Authentication: basic concepts, Kerberos. Resource sharing and load balancing. Special topics: distributed objects, distributed databases, directory services, web services.

Texts:

1. M. Singhal and N. Shivaratri, *Advanced Concepts in Operating Systems*, Tata McGraw-Hill, (2008)
2. N. Lynch, *Distributed Algorithms*, Elsevier India Private Limited, (2009)
3. Hagit Attiya, Jennifer Welch, *Distributed Computing: Fundamentals, Simulations and Advanced Topics*, Wiley, (2006)

References:

1. S.Ghosh, *Distributed Systems: An Algorithmic Approach*, Chapman & Hall, (2006)
2. A. Kshemkalyani, M. Singhal, *Distributed Computing: Principles, Algorithms, and Systems*, Cambridge University Press, (2008)
3. Gerard Tel, *Introduction to Distributed Algorithms*, 2nd edition, Cambridge University Press, (2004)
4. *Technical papers from major distributed systems journals and conferences*

CS741

TOPICS IN COMPUTER NETWORKS

3-0-0-6

Overview of computer networks, the Internet and OSI model Responsibilities of the Data Link Layer, Network Layer and Transport Layer; Local Area Networks – Ethernet, Token Ring etc. Scheduling algorithms and MAC layer protocols (Link Layer) Routing protocols - BGP, RIP, OSPF, AODV etc. (Network Layer). Congestion control Algorithms (Transport Layer). Peer-to-peer and client-server programming using sockets in TCP and UDP. Quality of Service (QoS) Provisioning Network Security

Texts:

1. A. S. Tanenbaum, *Computer Networks*, 4th Ed, Prentice Hall, (2003)

References:

1. B. A. Forouzan, *Data Communications and Networking*, 3rd Ed, McGraw Hill, (2004)
2. W. Stallings, *Data and Computer Communications*, 7th Ed, Prentice Hall of India, (2004)
3. J. F. Kurose and K. W. Ross, *Computer networking: A Top-down Approach Featuring the Internet*, 3rd Ed, Addison-Wesley, (2005)
4. W. Stevens and G. Wright, *TCP/IP Illustrated*, Volumes 1-3, (2002)
5. *Technical papers from major networking journals and conferences*

Introduction, Mathematical Tools for cryptography, Conventional Symmetric Encryption Algorithms, Modern Symmetric key encryption algorithm, Key distribution, Stream Ciphers, Pseudo Random Numbers, Public Key Cryptography, Hashes and Message Digests, Digital Signatures, Certificates, User Authentication. System authentication, IPSec, Virtual Private Networks Secure Socket layer, transport layer security.

Texts:

1. W. Stallings: *Cryptography and Network security Principles and Practices*, 4th Edition PHI, (2006)
2. D. R. Stinson: *Cryptography theory and practices*, 2nd Edition, CRC Press,(2006)

References:

Technical papers from major reputed journals and conferences and internet resources

CS702

ADVANCES IN ALGORITHMS

3-0-0-6

Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis; Graph Algorithms: Shortest paths, Flow networks; NP-completeness; Approximation algorithms; Randomized algorithms; Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations), Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).

Texts:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, *Introduction to Algorithms*, 2nd edition, Prentice-hall Of India Pvt.. Ltd, (2007)
2. J. Kleinberg and E. Tardos, *Algorithm Design*, Addison-Wesley, (2008)
3. Rajeev Motwani and Prabhakar Raghavan, *Randomized Algorithms*, Cambridge University Press, (1995)
4. Vijay Vazirani, *Approximation Algorithms*, Springer, (2004)
5. Soumen Chakrabarti, *Mining the Web: Discovering Knowledge from Hypertext Data*, Elsevier India Private Limited, (2005)

References

Technical papers from major reputed journals in the area of algorithms design.

CS703

QUANTUM COMPUTING

(3-0-0-6)

Introduction: Classical (reversible) Computing. Finite-dimensional Hilbert Spaces. Postulates of Quantum Mechanics. The Quantum Circuit Model of Computation. Quantum Gates. Universal Set of Gates. Quantum Superposition, Interference and Entanglement. The Quantum No-Cloning Theorem. Quantum Teleportation and Super dense Coding. **Quantum Algorithms:** The Early Ones: Deutsch, Deutsch-Josza and Simon's Algorithms. The Quantum Fourier Transform and its Applications: The Quantum Phase Estimation Algorithm. The Order Finding Algorithm. Shor's Integer Factorization Algorithm. **Quantum Search Algorithms:** Grover's Algorithm.

Glimpses of Quantum Computational Complexity Theory and Quantum Error Correction.

Text:

1. Michael Neilsson and Isaac L.Chuang, *Quantum Computation and Information*, Cambridge University Press, 2000.

Reference:

1. Mika Hirvensalo, *Quantum Computing*, Second Edition, Springer Verlag, 2004.
2. Current Research Literature.