Syllabus

Computer Network & Security

Data and Computer Communication Networks
Data Communication, Transmission Methodologies, Data Link Layer, Multiple Access & Local Area Networks, Connecting Devices and Backbone Networks, Network Layer and Transport Layer, Application Layer.

Mobile & Wireless Networks
Wireless networking, wireless LANS & PANS, ad-hoc wireless networks & security, wireless sensor networks, Cellular Mobile Wireless Networks, Evolution of Modern Mobile Wireless Communication System.

Cryptography and Network Security
Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

Database Security
Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multilevel relational data models, Security impact on database function, inference problem

Software Security
Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge

Intrusion detection
Defining Intrusion Detection, Security concepts intrusion Detection concept, determining strategies for Intrusion Detection, Responses, Vulnerability Analysis, Credentialed approaches, Technical issues.

Biometric Security
Biometric Fundamentals, Types of Biometrics, Fingerprints and Hand Geometry, Facial and Voice Recognition, Iris and Retina scanning, Signature Recognition and Keystroke Dynamics, Behavioral and Esoteric Biometric Technologies, Issues Involving Biometrics, Privacy, Policy and Legal Concerns Raised by Biometrics.

Distributed Computing

Overview of Computing Paradigm, Introduction to distributed programming: Anatomy of a Distributed Application, Requirements for Developing Distributed Applications, Introduction to sockets programming: Sockets and Streams, Distributing Objects, CORBA, Java RMI, RMI vs. CORBA, Thread, Message passing systems and its need, Peer-to-peer communication and group communication, Service Oriented Architecture

Parallel Computing: Flynn's Classification of Computer Architecture, Types of Parallelism, Parallel programming models

Cluster Computing: Cluster setup and its Administration, Performance Models & Simulations; Networking, Distributed shared memory, parallel I/O Clusters, Scheduling parallel jobs on clusters, Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing, Cluster System – Beowlf, COMPaS and NanOS

Grid Computing: Data and Computational Grids, Grid Architectures and its relations to various Distributed Technologies.

Cloud Computing: Evolution of cloud computing, Comparison with traditional computing architecture (client/server), Services provided at various levels, Role of Networks in Cloud computing, Role of Web services; Service Models (SaaS): Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud, Cloud Security

Distributed systems: Characteristics, challenges, clocks, events and process status, synchronizing physical clocks, logical time and logical clocks, global states, Distributed Mutual Exclusion**,** Distributed concurrency control, Distributed deadlock

Text Book :

1. Java Distributed Computing, Jim Farley, O'Reilly.

2.Service Oriented Architecture With Java, Malhar Barai, Vincenzo Caselli, Binildas A. Christudas, Packt Publishing, 2008.

3. Distributed Programming with Java, Qusay H. Mahmoud, Manning Publisher 2000.

4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

5.George Couluris, Jean Dollimore, "Distributed Systems Concepts & Design", Pearson education, 3rd edition, 2006.

6. N.A. Lynch: Distributed Algorithms, Morgan Kayfmann Publishing Inc., CA, 1996.

7. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed System: Principles & Paradigms, Prentice Hall, 2007

Software Engineering
Software Engineering Foundation- Overview, Characteristics of software Engineering, Basic Constraints of software Engineering, Approaches to software engineering, trans disciplinary foundation of software engineering, principles for software engineering, A unified framework of software engineering principles, software engineering principles as measured to its constraints, philosophy of science and engineering, formal inference methodologies, nature of software, philosophy of software engineering, data object modelling and manipulation, basic engineering principles, Engineering principles for software engineering, theory of software engineering organization, empirical software engineering, cognitive informatics foundation of software engineering, cognitive informatics for software engineering, cognitive complexity of software.

Software Project management- Managing software project, the project planning infrastructure, process planning, effort estimation and scheduling, quality planning, risk management, measurement and tracking planning, project management plan, configurations plan, reviews, project monitoring and control, project closure.

Software Metrics- the basics of measurement, a goal based framework for software measurement, Empirical investigation, software metrics data collection, analysing software measurement data, measuring internal product attributes: size and structure, measuring external product attributes, software reliability: measurement and prediction, resource measurement: productivity, teams and tools, making process predictions, planning a measurement, measurement in practice, empirical research in software engineering.

Software Testing- Software testing fundamentals, Testing Object-Oriented software, testing web application, optimizing test cases, creating quality software, applying software standards to test documentation.

Software Security- Software Security fundamentals, a risk management framework, code review with tools, Architectural risk analysis, software penetrating testing, risk based security testing, an enterprise software security

program, security knowledge, a taxonomy of coding errors. **Software Reliability-** Introduction to reliability engineering, software reliability, Software Reliability approaches, Software reliability modelling, special topics in software reliability

Machine Learning

Basics: What is Machine Learning, The concept Learning task, General-to-specific ordering of hypotheses, Version spaces, Inductive bias, Over-fitting, Cross-Validation, Machine Learning Applications.

Probabilistic Models: Maximum Likelihood Estimation, MAP, Bayes Classifiers, Minimum description length principle, Bayesian Networks, Inference in Bayesian Networks, Bayes Net Structure Learning.

Supervised learning: Decision Tree Learning, Instance-Based Learning: k-Nearest neighbor algorithm, Support Vector Machines, Support vector machines for classification and regression, Kernel methods, Artificial Neural Networks: Linear threshold units, Perceptrons, Multilayer networks and back-propagation.

Ensemble learning: Boosting, Bagging, Random Forest

Unsupervised learning: K-means and Hierarchical Clustering, Fuzzy-C-means, Gaussian Mixture Models, EM algorithm, Hidden Markov Models.

Computational Learning Theory: Probably Approximately Correct (PAC) learning, Sample complexity, Computational complexity of training, Vapnik-Chervonenkis (VC) dimension, Reinforcement Learning.

Reference Books

- Tom Mitchell. Machine Learning. McGraw Hill, 1997.
- Christopher M. Bishop. Pattern Recognition and Machine Learning. Springer 2006.
- Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. John Wiley & Sons, 2006.
- E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.