Department of Computer Science and Engineering

CS-701: Software Engineering & Cloud Computing

Software Engineering:

Topic	# hours
Introduction to Software Engineering: Definitions, Opportunities & Challenges	**1**
Software Engineering Research Objectives	**1**
Software Productivity, Software Metrics, Software Process, Software Benchmarks	**1**
Overview of Software Requirements Engineering & Research Possibilities	**2**
Overview of Software Quality Management & Research Possibilities	**2**
Overview of Traditional SDLC-Methodologies & Research Possibilities	**2**
Overview of Agile SDLC-Methodologies & Research Possibilities	**2**
Review of Current Trends and Research Directions in Software Engineering (*including presentation from Research Scholars*) – after review of papers from reputed journals (*IEEE Transactions on Software Engineering, IEEE Software, IEEE Computer etc.*)	**4**
Assessment	**2**

Cloud Computing:

Topic	# hours
Introduction to Cloud Computing (CC): Definitions, Components of a Computing Cloud, Differentiating Types of Cloud: Public, Private & Hybrid clouds	**2**
Delivering Services from Cloud: Categorizing Service Types, Comparing Vendor Cloud Products: Amazon, Google, Microsoft and others	**2**
Barriers to Cloud Computing: Handling sensitive data, Aspects of cloud security, Assessing governance solutions	**1**
Cloud Computing Reference Architecture(s): Oracle, NIST, IBM's Open Cloud Architecture, Openstack (www.openstack.org)	**3**
Overview of SaaS and Case-Studies	**2**
Overview of PaaS and Case-Studies	**2**
Overview of IaaS and Case-Studies	**2**
Review of Current Trends and Research Directions in Cloud Computing (*including presentation from Research Scholars*) – after review of papers from reputed journals (*IEEE Transactions on Cloud Computing, IEEE Software, IEEE Computer etc.*)	**4**
Assessment	**2**

References:

- Software Engineering Books – available in Departmental & Central Library of University
- Research Papers – available in reputed Journals (IEEE-Transactions, Springer, ACM etc.)

Pre PhD Course
Network and Security
CS-702

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Unit-1

OSI layered architecture, TCP/IP protocol suite. **Physical Layer:** Transmission Media Guided media, Twisted pair, coaxial cable, fiber optics. Unguided media: radio waves, microwaves & infrared waves. **Data Link Layer:** Random Access protocol ALOHA, CSMA, CSMA/CD. Channelization: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access. Sliding Window Protocols: Designing and functioning of Go-Back-N, Selective Repeat method

Unit-2

Network Layer: IPv4 Addressing, Classful addressing, classless addressing. Datagram formats for IPv4 and IPv6 addresses. Address mapping protocols: ARP and RARP. Unicast routing: Distance vector routing-RIP and Link state routing-OSPF. Path vector routing-BGP. **Transport Layer:** Process to process delivery, User data gram protocol, Transmission control protocol. Congestion Control: Leaky bucket and token bucket. **Application Layer:** Domain name System: Name space, Domain Name space, Distribution of domain name space

Unit-3

Introduction of ad-hoc/sensor networks: Key definitions of ad-hoc/sensor networks, constraints and characteristics of MANET, challenges & Performance parameters of Adhoc networks, Types & Applications of MANETs, **Wireless sensor networks:** Introduction of sensor network, sensor networks vs. ad-hoc networks, sensor network limitations, Design Issues, Challenges of Wireless sensor network, Energy consumption, Clustering of sensors- regularly placed sensor, randomly distributed sensors.

Unit-4

Routing in Ad Hoc Networks: Introduction, Topology based routing protocol- Proactive routing- DSDV, WRP, TBRPF, OLSR, multipoint relay, Reactive routing- DSR, AODV, Hybrid routing approach- ZRP, CBRP, Position based routing- Location services- DREAM, quorum based location service, GLS, home zone, forwarding strategies- greedy packet forwarding, Restricted Directional flooding- DREAM, LAR, Hierarchical routing.

Unit-5

Security: Introduction to OSI Security Architecture: Conventional Encryption: Conventional Encryption Model, Classical Encryption Techniques - Substitution Ciphers: Transpositions Ciphers: Cryptanalysis. Data Encryption Standards (DES), Principles of Public Key Cryptosystems: RSA Algorithm: Key Management, Diffie-Heilman Key Exchange Algorithm, Message Authentication & Hash Functions. Security of Hash Function & MACS, Authentication Applications: Kerberos Version 4, Viruses and Related Threats: Malicious Programs.

REFERENCES:

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Prentice Hall, New Jersey.
2. Forouzen,"Data Communication and Networking",TMH
3. A.S.Tanenbaum,"Computer Networks",3rd Edition,Prentice Hall India,1997.
4. AD HOC & SENSOR NETWORK "Theory and Application" by Carlos de Morais Cordeiro, World scientific press.

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Distributed Operating Systems, Subject Code: CS-703
w.e.f. 2018

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UNIT 1

Advanced Operating Systems:

Characterization of distributed systems, Design goals, Communication and computer networks, Distributed processing, Distributed operating systems, Client Server Communications.

Inter process Communication: API for internet protocol, Marshalling. Client server communication, group communication Case Study: CBCAST protocol in ISIS. [9]

UNIT 2

Distributed objects and remote invocation: communication between Distributed objects, Remote Procedure calls, events and notification Case Study: Java RMI.

Operating System Support: Operating System layer. Protection, processes and threads, operating system architecture.

Distributed clock synchronization: physical clock, logical clock. [8]

UNIT-3

Distributed File System: Models, service interface and directory interface design, DFS system structure, File Service, Name Service

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Security in distributed systems: problems and design issues.

Fault tolerance and recovery: basic concepts, fault models, agreement problems and its applications, commit protocols, voting protocols, check pointing and recovery. [8]

UNIT -4

Distributed transactions and concurrency control, fault tolerance and security. Synchronization & Coordination.

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Distributed shared memory: design and implementation issues, sequential consistency and Ivy. Case Study: Munin [8]

UNIT-5

Real time distributed operating system: Design issues, distributed communications in LAN and WAN, scheduling: Static and dynamic, scheduling algorithms, Case Study: MARS. Distributed Algorithms, research issues. [9]

REFERENCE:

1. Distributed Systems –Coulouris [Pearson Education]
2. Distributed Operating Systems-Tannenbaum [Pearson Education]
3. Distributed Systems : Principles and Paradigms –Tannenbaum [Pearson Education]

DIGITAL IMAGE PROCESSING & ITS APPLICATIONS
Subject Code: CS-704

w.e.f. 2018

UNIT 1:
Digital Image Fundamentals: Image Sensing, and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels.
Sensor and Imaging: Imaging Optics, Radiometry of Imaging, illumination sources and techniques, Camera Principles, Color Imaging, Single Sensor Color Imaging and Color Demosaicing, Range Images, 3D Imaging. [8]

UNIT 2:
Signal Representation: Vector Space and Unitary Trasnsforms, Multi-Resolutional Signal Representation, Wavelet Decomposition, Scale space and diffusion, Representation of color, Retinex Processing, Markov Random Field Modellings of Images.
[8]

UNIT 3:
Non-linear Image Processing: Median and Order Statistics Filters, Rank -Ordered-Mean Filters and Signal Dependent Rank-Ordered-Mean Filters, Two Dimensional Teager Filters, Applications of nonlinear filters in image enhancement, edge detections, noise removal etc.
[9]

UNIT 4:
Image Processing in Biometric Security : Introduction, Fingerprint Recognition, Face Recognition, Iris Recognition, Vein Pattern Recognition, Multimodal Biometrics Techniques. Biometric System Architeture, Extraction Algorithm, Matching Algorithm, Authentication, Biometric System Evaluation, Privacy issues.
[9]

UNIT 5:
Image Processing in Medical Field: Introduction, CT scan images, MRI, Seeded segmentation methods : Desirable properties, Pixel Based Methods, Contour Based Methods, Geodesic Active Contours, level set method, deformable model, graph based method, Image analysis of retinal images : acquisition, preprocessing. [8]

References:
1. R.C Gonzalez and R.E. Woods, " Digital Image Pr ocessing" , Addison Wesley, 1992.
2. A.K.J ain, " Fundamentals of Digital Image Pr ocessing" , Pr entice Hall of India.
3. Digital Image Processing–M. Anji Reddy, BS Publications.

Integral University, Lucknow Department of Computer Science & Engineering

Subject Name: Soft Computing, Subject Code: CS-705
w.e.f. July-2018

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UNIT-1 Introduction of soft computing:
What is Soft Computing, soft computing vs. hard computing, soft computing paradigms, and applications of soft computing. **Basics of Machine Learning**. **Dealing with Imprecision and Uncertainty-** Probabilistic Reasoning- Bayesian network.

UNIT-2 Neural Networks:
Basics of Neural Networks- Neural Network Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, characteristics and applications of ANN, McCulloch Pitt model, different activation functions, **Supervised Learning algorithms-** Perceptron (Single Layer, Multi layer), Back Propagation algorithm, **Un-Supervised Learning algorithms-** Hebbian Learning, Adaptive Resonance Theory: Architecture, classifications, Implementation and training.

UNIT-3 Fuzzy Logic:
Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. **Fuzzy Models** – Sugeno Fuzzy Models, Adaptive Neuro-Fuzzy Inference Systems Architecture.

UNIT-4 Genetic Algorithms & Modeling:
Introduction, Encoding, Operators of Genetic Algorithms, Basic Genetic Algorithms, and Hybrid Systems: Integration of NN, GA and FS. Introduction to SVM, SOM, etc.

UNIT-5 Evolutionary Computing:
Ant colony optimization (ACO), Particle swarm optimization (PSO), Artificial Immune System (AIS)Genetic programming (GP).

References :

1. S, Rajasekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications", PHI Publication.
2. S.N. Sivanandam & S.N. Deepa, "Principles of Soft Computing", Wiley Publications.
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.
4. SAndries P Engelbrecht, Computational Intelligence: An Introduction, Wiley Publications.

Prerequisite – None,Corequisite - None

Big Data Analytics CS-707

UNIT 1

Big Data and its Complexity, Different architectures of Big Data Processing, Technologies related to Big Data, Big Data Values in different aspects such as Business , Data Warehouse and its Re-Engineering, Workload Management.

UNIT 2

Big Data and its integration with Data Warehouse, Data Driven Architecture, Information Management and Lifecycle, Big Data Analytics, Use of Visualization in Big Data, How to Implement Big Data. Implementation Interfaces, Manipulation of Data, Exploration of Data, Building Regression Models, Clustering and Data Segmentation, Forecasting and Time Series Models.

Unit 3

Hadoop Map Reduce Programs, Learning Data Analytics with Hadoop, Understanding Big Data Analysis with Machine Learning. Big Data, Web Data, A Cross-Section of Big Data Sources, Taming Big Data, Analytic Scalability evolution.

Unit-4

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop(Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local,Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

Writing MapReduce Programs: Understanding Hadoop API for MapReduce Framework, Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

Unit-5

Analytic Processes, Analytic Tools and Methods. Legacy Data, Hypothesis Testing, Prediction, Software, Complexity, Business problems suited to big data analytics.

Big Data's Implication for Businesses, Big Data Implications for Information Management, Hive's Basic Operations on Big Data.

References

1. Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1 st Edition, by J Berman, published by Morgan Kaufmann
2. Franks, Bill, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley, 1st Edition, 2012.
3. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O’reilly, Hadoop in Action by Chuck Lam, MANNING Publ