MCA 4th SEMESTER SYLLABUS
DEPARTMENT OF COMPUTER SCIENCE & IT
COTTON UNIVERSITY

PAPER: MCA1001C

COMPUTER NETWORKS
(Credits: 3+1+0=4)

UNIT I: Introduction to Computer Networks [6 Lectures]
Uses of Computer Networks; Wired and wireless Networks; Types of networks – LAN, MAN, WAN; Network Topology; OSI Reference Model – Outline, Protocol hierarchies, Design considerations; TCP-IP Reference Model; Comparison among these reference models.

UNIT II: Physical Layer [6 Lectures]
Fourier Analysis (Qualitative), Maximum data rate of a Channel, Bit rate and Baud; Baseband and Broadband; Guided Transmission Media- Magnetic, Twisted pair, Coaxial cable, Fibre Optics, Wireless transmission – Electromagnetic Spectrum, Radio transmission, Microwave Transmission, Infrared transmission; Comparison among the different transmission media – guided and unguided.

UNIT III: Data Link Layer [8 Lectures]
Design Issues - Services provided to the higher layer, Framing, Error Control, Flow Control; Error Detection and Correction – Error Correcting Codes, Error-Detecting Codes; Elementary Data Link Protocols – Unrestricted simplex protocol, Simplex stop-and-wait protocol, Protocol for Noisy Channel; Sliding Window protocols – One bit sliding window, Go Back n protocol, Protocol using Selective Repeat.

UNIT IV: Medium Access Control Sublayer [8 Lectures]
Random Access Protocols-ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization; X.25, ATM, LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11.

UNIT V: Network Layer [8 Lectures]
Design Issues – Store and forward packet switching, Services provided to higher layer, Connection Oriented and Connectionless services, Virtual Circuits and Datagram subnets; Routing Algorithms – Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Congestion Control Algorithms – General Principles, Congestion Prevention Policies, Congestion control in Virtual Circuit and Datagram Subnets; Internetworking – Tunneling, Fragmentation; Internet Protocol – IP addresses, Subnets, CIDR, Network address translation,; Internet Control Protocol – ICMP, ARP, RARP, BOOTP, DHCP.

UNIT VI: Transport layer [6 Lectures]
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT VII: Application Layer [6 Lectures]
Domain Name System – name space, resource records, name servers; Electronic Mail- architecture and services, user agent, Message formats – MIME, Message Transfer - SMTP, Message Delivery – POP3 and IMAP, Web mail.
Cryptography, Substitution Ciphers, Transposition Ciphers, One time pads, Cryptographic principles; Symmetric Key Algorithms – Data Encryption Standard, Public Key Algorithms – RSA.

Textbooks:
1.A.S. Tanenbaum: Computer Networks, PHI

Recommended Books:

1.William Stallings, Data and Computer Communications, Pearson Education
2.Behrouz Forouzan and S.C. Fegan: Data Communications and Networking, McGraw Hill
3.W. Tomasi: Introduction to Data Communications and Networking, Pearson Education
4.P.C. Gupta, Data Communications and Computer Networks, PHI

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PAPER: MCA1002C

FORMAL LANGUAGES AND AUTOMATA THEORY

(Credits: 3+1+0=4)

UNIT I: Basics of Automata [10 Lectures]

Alphabets, languages, and grammars. Deterministic and nondeterministic finite automata (DFAs and NFAs); NFA with ε-moves, Equivalence of DFA and NFA; Reduction of the number of states in a finite automata

UNIT II: Regular Languages and Regular Grammar [12 Lectures]

Regular expressions; Connection between regular expressions and regular languages; Closure under simple set operations- union, intersection, concatenation, complementation and star-closure; Regular grammars, Right and Left-Linear Grammars; Myhill-Nerode theorem, Proof of non-regularity using Pigeonhole principle and using pumping lemma for regular languages.

UNIT III: Context free languages [8 Lectures]

Context-free grammars, leftmost and rightmost derivations, derivation trees; Parsing and Ambiguity in grammars and languages; Simplification of Context free Grammars- removing useless productions, empty-productions and unit-productions. Normal forms- Chomsky and Greibach normal forms.

UNIT IV: Pushdown Automata and Context Sensitive Languages [8 Lectures]

Definition and language accepted (acceptance by empty stack and final state and their equivalence). Pushdown Automata and Context free languages. Closure properties of CFL; Decidable properties of CFL; Pumping lemma and Ogden's Lemma; Context sensitive languages: context sensitive grammars, linear bounded automata.

UNIT V: Turing machines [10 Lectures]

Definition, Designing of Turing machine, computable function, Church's hypothesis, Halting problem, Recursively enumerable languages: unrestricted grammars, Universal Turing Machines and its applications.

Textbooks:

1. An introduction to Formal Languages and Automata, Peter Linz, Narosa.

Recommended Books:

1.Introduction to Automata Theory, Languages and Computation, Hopcroft and Ullman, Addison Wesley.
2.K. L. P. Mishra, N. Chandrasekaran; Theory of Computer Science (Automata, Languages and

Computation), P. H. I.
3.T. H. Cormen, SC. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.

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PAPER: MCA1003L

LAB - IV

(Credits: 0+1+2=3)

Lab programs related with MCA C12: Computer Networks

1. Bit Stuffing and Character Stuffing
2. CRC,CRC-12,CRC-16,CRC-CCIT
3. Dijkstra's Shotest path routing algorithm
4. Distance vector routing algorithm
5. Link state routing algorithm
6. Floding
7. Broadcasting
8. Congestion control using Leaky bucket algorithm
9. TCP and UDP Socket programming
10. Simple RSA algorithm to encrypt and decrypt the data

The course instructor may assign additional questions if s/he feels necessary.

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(Open Elective)

PAPER: MCA1004P

INTRODUCTION TO BIG DATA AND MACHINE LEARNING

(Credits: 3+1+0=4)

UNIT I: Introduction to big data and hadoop [10 Lectures]
Types of Digital data, Introduction to Big data, Big data analytics, History of Hadoop, Apache hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere, Big Insights and Big Sheets, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Dataflow, Data Ingest with Flume and scoop and Hadoop archives, Hadoop I/O: Compression, serialization, Avro and File-based Data structures.

UNIT II: Map Reduce & Hadoop Eco System [8 Lectures]
Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, PIG, HIVE, Hbase, BigSQL and NoSQL.

UNIT III: Data Analytics with R [6 Lectures]
Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

UNIT IV: Introduction to machine learning [8 Lectures]
Definition of learning systems. Goals, applications, aspects, Concept representation, Function approximation. Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. Inductive bias.

UNIT V: Decision Tree Learning [10 Lectures]
Entropy and information gain. Occam's razor. Overfitting, noisy data, and pruning. Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles. Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

UNIT VI: Artificial Neural Networks [6 Lectures]
Neurons, Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation

Textbooks:
1. TomWhite“Hadoop:TheDefinitiveGuide”ThirdEditon,O’reilyMedia,2012.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

Recommended books:
1.MichaelBerthold,DavidJ.Hand,"IntelligentDataAnalysis”,Springer,2007.
2.JayLiebowitz,“BigDataandBusinessAnalytics”AuerbachPublications,CRCpress(2013)
3.TomPlunkett,MarkHornick,“UsingRtoUnlocktheValueofBigData:BigDataAnalyticswithOracle
4.REnterpriseandOracleRConnectorforHadoop”,McGraw-Hill/OsborneMedia(2013),Oraclepress.
5.GlenJ.Myat,“MakingSenseofData”,JohnWiley&Sons,2007
6.PeteWarden,“BigDataGlossary”,O’Reily,2011.
7.MichaelMineli,MicheleChambers,AmbigaDhiraj,"BigData,BigAnalytics:EmergingBusinessIntelligence andAnalyticTrendsforToday'sBusinesses",WileyPublications,2013.
8.ArvindSathi,“BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame”,MCPress,2012
9.EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.Tom Mitchell, "Machine Learning", McGraw-Hill, 1997

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