MANAGING BIG DATA
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - II

Subject Code	16LNI422 / 16SCE21 / 16SCN24 / **16SCS21** / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define big data for business intelligence
- Analyze business case studies for big data analytics
- Explain managing of Big data Without SQL
- Develop map-reduce analytics using Hadoop and related tools

Module -1	**Teaching Hours**
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.	**10Hours**
Module -2	
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.	**10 Hours**
Module – 3	
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.	**10 Hours**
Module-4	
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats	**10 Hours**
Module-5	
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.	**10 Hours**

Course outcomes:

The students shall able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop

- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	16SCN12/**16SCS22**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss with the basics of Computer Networks.
- Compare various Network architectures.
- Discuss fundamental protocols.
- Define and analyze network traffic, congestion, controlling and resource allocation.

Module 1	**Teaching Hours**
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. **T1**: **Chapter 1.1, 1.2, 1.5.1, 1.5.2**., **2.1, 2.5** **T2**: **Chapter 4**	**10 Hours**
Module 2	
Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. **T1:** Chapter 3.1, 3.2,	**10 Hours**
Module 3	
Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP **T1:** Chapter 3.3, 4.1.1,4.1.3 **T2**:Chapter 13.1 to 13.18 , Ch 18.	**10 Hours**
Module 4	
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery **T1:** Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3	**10 Hours**
Module 5	
Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) **T1:** Chapter 6.4 **T2**: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8	**10 Hours**

Course Outcomes

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.

- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition , Elsevier -2014.
2. Douglas E Comer, **"**Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI – 2014.

Reference Books:

1. Uyless Black, "Computer Networks, Protocols , Standards and Inte rfaces" 2 nd Edition - PHI.
2. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill.

ADVANCED ALGORITHMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	**16SCS23**/ 16SSE253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define the graph search algorithms.
- Explain network flow and linear programming problems.
- Interpret hill climbing and dynamic programming design techniques.
- Develop recursive backtracking algorithms.
- Define NP completeness and randomized algorithms

Module -1	**Teaching Hours**
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.	**10Hours**
Module -2	
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.	**10 Hours**
Module – 3	
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization	**10 Hours**
Module-4	
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.	**10 Hours**
Module-5	
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.	**10 Hours**
Course outcomes:	

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

INTERNET OF THINGS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	16LNI253 /16SCE253 /16SCN151 /**16SCS24** /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and explain basic issues, policy and challenges in the IoT
- Illustrate Mechanism and Key Technologies in IoT
- Explain the Standard of the IoT
- Explain resources in the IoT and deploy of resources into business
- Demonstrate data analytics for IoT

Module -1	**Teaching Hours**
What is The Internet of Things? Overview and Motivations, Examples of Apllications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation.Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Apjplication Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.	**10Hours**
Module -2	

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches,IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol,Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP),IPSO	**10 Hours**
Module – 3	
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT:Overview and Motivations.Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes,Quality of Service in IPv6, Migration Strategies to IPv6.	**10 Hours**
Module-4	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.	**10 Hours**
Module-5	
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.	**10 Hours**
Course outcomes:	
At the end of this course the students will be able to: • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business • Understand the practical knowledge through different case studies • Understand data sets received through IoT devices and tools used for analysis	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013. 2. Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015	
Reference Books: 1. Michael Miller,” The Internet of Things”, First Edition, Pearson, 2015. 2. Claire Rowland,Elizabeth Goodman et.al.,” Designing Connected Products”, First Edition,O’Reilly, 2015.	

ARTIFICIAL INTELLIGENCE AND AGENT TECHNOLOGY **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2016 -2017)** **SEMESTER - II**			
Subject Code	**16SCS251**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			

- Apply a given AI technique to a given concrete problem
- Implement non-trivial AI techniques in a relatively large system
- Explain uncertainty and Problem solving techniques.
- Illustrate various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- Contrast different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- Compare various learning techniques and agent technology.

Module -1	**Teaching Hours**
What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. Intelligent Agents: Agents and Environments, The nature of environments, The structure of agents. Text Book 1: Chapter 1 & 2 Text Book 2: Chapter 2	**8 Hours**
Module -2	
Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction. Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6	**8 Hours**
Module – 3	
Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search. Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic. Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited. Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13	**8 Hours**
Module-4	
Weak Slot-and-filter structures: Semantic Nets, Frames. Strong slot-and –filler structures: Conceptual dependency, scripts, CYC. Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary. Text Book 1: Chapter 9 & 10Text Book 2: Chapter 5	**8 Hours**
Module-5	
Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning. Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm. Text Book 2: Chapter 18 & 20	**8 Hours**
Course outcomes:	
The students are able to: • Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of	

existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books:
1. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

PATTERN RECOGNITION
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - II

Subject Code	16SCE252/ **16SCS252**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to
- Explain various Image processing and Pattern recognition techniques.
- Illustrate mathematical morphology necessary for Pattern recognition.
- Demonstrate Image Representation and description and feature extraction.
- Explain principles of decision trees and clustering in pattern recognition.

Module -1	**Teaching Hours**
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems	**8 Hours**
Module -2	
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation	**8 Hours**
Module – 3	
Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive bayes classifier, Bayessian belief network	**8 Hours**
Module-4	
Naive bayes classifier, Bayessian belief network,Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM	**8 Hours**
Module-5	
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards,	**8 Hours**

Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition	

Course outcomes:

The students shall able to:

- Explain pattern recognition principals
- Develop algorithms for Pattern Recognition.
- Develop and analyze decision tress.
- Design the nearest neighbor classifier.
- Apply Decision tree and clustering techniques to various applications

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, 2011 Universities Press, ISBN 978-81-7371-725-3
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PH ISBN-81-203-1484-0, 1996.

Reference Books:

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

INFORMATION AND NETWORK SECURITY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	16LNI12/16SCN13/**16SCS253**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain standard algorithms used to provide confidentiality, integrity and authenticity.
- Distinguish key distribution and management schemes.
- Deploy encryption techniques to secure data in transit across data networks
- Implement security applications in the field of Information technology

Module 1	**Teaching Hours**
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm	**8 Hours**
Module 2	
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.	**8 Hours**
Module 3	
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.	**8 Hours**
Module 4	
Wireless network security: Wireless security, Wireless network threats, Wireless	**8 Hours**

network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. W**eb Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer: SSL** Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell(SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol	
Module 5	
Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.	**8 Hours**
Course Outcomes	
The students should be able to: • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. William Stallings, Cryptography and Network Security, Pearson 6th edition.	
Reference Books: 1. V K Pachghare: Cryptography and Information Security.	

WEB SERVICES **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2016 -2017)** **SEMESTER – II**			
Subject Code	**16SCS254** / 16SSE154 / 16LNI252 / 16SIT21	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			

- Define and explain Web Services.
- Summarize WSDL Web Services.
- Analyze Web service Architecture.
- Explain Building Blocks of Web services.

Module 1	**Teaching Hours**
Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware.	**8 Hours**
Module 2	
Web Services: Web Services Technologies, Web Services Architecture.	**8 Hours**
Module 3	
Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards.	**8 Hours**
Module 4	
Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols.	**8 Hours**
Module 5	
Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example.	**8 Hours**

Course Outcomes

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Reference Books:

NIL

MINIPROJECT **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2016 -2017)** **SEMESTER – II**			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /**16SCS26** /16SFC26 / 16SIT26 / 16SSE26	IA Marks	20

Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	------	Exam Hours	03

CREDITS – 02

C**ourse objectives:** This course will enable students to

- Enable the student to design, develop and analyze an application development

The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.

Course outcomes:

- Design, develop and to analyze an application development.
- Prepare report of the project.

Conduction of Practical Examination:

The student shall prepare the report by including:

1. Define project (Problem Definition)
2. Prepare requirements document
   a. Statement of work
   b. Functional requirements
   c. Software / Hardware requirements
3. Develop use cases
4. Research, analyze and evaluate existing learning materials on the application
5. Develop user interface and implement code
6. Prepare for final demo

Evaluation:

Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20 = 80 marks.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / **16SCS27** / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-

CREDITS – 01

Course objectives: This course will enable students to

- Motivate the students to read technical article
- Discover recent technology developments

Descriptions

The students should read a recent technical article (try to narrow down the topic as much as possible)

from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

MACHINE LEARNING TECHNIQUES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - IV

Subject Code	**16SCS41**/16SIT424	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain basic concepts of learning and decision trees.
- Compare and contrast neural networks and genetic algorithms
- Apply the Bayesian techniques and instant based learning
- Examine analytical learning and reinforced learning

Module -1	**Teaching Hours**
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search	**10Hours**
Module -2	
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.	**10 Hours**
Module – 3	
BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes	**10 Hours**

Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	
Module-4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution	**10 Hours**
Module-5	
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	**10 Hours**
Course outcomes:	
On Completion of the course, the students will be able to • Choose the learning techniques with this basic knowledge. • Apply effectively neural networks and genetic algorithms for appropriate applications. • Apply bayesian techniques and derive effectively learning rules. • Choose and differentiate reinforcement and analytical learning techniques	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.	
Reference Books: 1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013. 2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.	

Computer Vision **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2016 -2017)** **SEMESTER - IV**			
Subject Code	**16SCS421**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to • Review image processing techniques for computer vision • Discuss shape and region analysis • Analyze Hough Transform and its applications to detect lines, circles, ellipses • Analyze three-dimensional image analysis techniques • Illustrate motion analysis • Discuss some applications of computer vision algorithms			

Module -1	**Teaching Hours**
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	**8 Hours**
Module -2	
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	**8 Hours**
Module – 3	
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	**8 Hours**
Module-4	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	**8 Hours**
Module-5	
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	**8 Hours**
Course outcomes:	
Upon completion of the course, the students will be able to • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning	

(Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

BUSINESS INTELLIGENCE AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - IV

Subject Code	16SIT421 / **16SCS422**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Evaluate the key elements of a successful business intelligence (BI) program
- Apply a BI meta model that turns outcomes into actions
- Extract and transform data from an operational data to a data business data
- Evaluate business analytics and performance measurement tools

Module -1	**Teaching Hours**
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation	**8 Hours**
Module -2	
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process	**8 Hours**
Module – 3	
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery	**8 Hours**
Module-4	
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard	**8 Hours**
Module-5	
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.	**8 Hours**

Course outcomes:

Upon completion of the course, the students will be able to

- Explain the complete life cycle of BI/Analytical development
- Illustrate technology and processes associated with Business Intelligence framework
- Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

1. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
2. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
3. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

AGILE TECHNOLOGIES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – IV

Subject Code	**16SCS423** /16SSE423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain iterative, incremental development process leads to faster delivery of more useful software
- Evaluate essence of agile development methods
- Illustrate the principles and practices of extreme programming
- Show the roles of prototyping in the software process
- Explain the Mastering Agility

Module -1	**Teaching Hours**
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor	**8 Hours**
Module -2	
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility	**8 Hours**
Module – 3	

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing	**8 Hours**
Module-4	
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	**8 Hours**
Module-5	
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	**8 Hours**

Course outcomes:

Students should be able to

- Define XP Lifecycle, XP Concepts, Adopting XP
- Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Demonstrate concepts to Eliminate Waste

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
2. Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004

WIRELESS NETWORKS AND MOBILE COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – IV

Subject Code	16SCE22 / **16SCS424**	IA Marks	20

Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- Explain CDMA, GSM. Mobile IP, WImax and Different Mobile OS
- Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

Module -1	**Teaching Hours**
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.	**8 Hours**
Module -2	
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6	**8 Hours**
Module – 3	
Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators	**8 Hours**
Module-4	
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.	**8 Hours**
Module-5	
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.	**8 Hours**

Course outcomes:

The students shall able to:

- Explain state of art techniques in wireless communication.
- Discover CDMA, GSM. Mobile IP, WImax
- Demonstrate program for CLDC, MIDP let model and security concerns

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.