15NN01/15NB01   NUMBER THEORY AND QUANTITATIVE TECHNIQUES

2 2 0 3

NUMBER THEORY: The fundamental theorem of arithmetic, division algorithm, Euclidean algorithm, extended Euclidean algorithm. Arithmetical function - Euler totient function – congruence - basic properties of congruence, modulo groups, residue classes and complete residue system, linear congruences, Euler- Fermat theorem, the Chinese remainder theorem - pseudo random number generation - linear congruential generator, Blum-Blum-Shub generator - probabilistic primality tests - Fermat's test, Solovay-Strassen test, Miller-Rabin test .   (6+5)

APPLICATIONS OF NUMBER THEORY: Block and stream ciphers - public key encryption - RSA cryptosystem - elliptic curve cryptosystems.   (4+5)

LINEAR PROGRAMMING: Mathematical formulation, graphical method, simplex method, two phase method, duality in linear programming, dual simplex method, transportation and assignment problems.   (9+5)

NON-LINEAR PROGRAMMING: Introduction- interval halving method – Fibonacci method – univariate method - pattern directions – Hooke Jeeves method - steepest descent method - conjugate gradient method - Fletcher Reeves method.   (4+5)

PERT/CPM: Network representation, critical path computation, crashing, PERT calculations - resource analysis in network scheduling.   (4+5)

DECISION ANALYSIS AND GAMES: Decision making under certainty: analytic hierarchy process, decision making under risk, decision under uncertainty, game theory: basic terminologies - optimal solution of two-person zero-sum games - solution of mixed strategy games.   (3+5)

Total L:30+T:30=60

REFERENCES:
1.   Tom M Apostol, "Introduction to Analytic Number theory", Narosa Publishing House, New Delhi, 2010.
2.   Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone, "Handbook of Applied Cryptography", CRC Press, Florida, 2010.
3.   Hamdy A Taha, "Operations Research: An Introduction", Pearson Education, New Delhi, 2012.
4.   Singaresu S Rao, "Engineering Optimization: Theory and Practice", New Age International, New Delhi, 2011.
5.   Sharma J K, "Operations Research: Theory and Applications", Macmillan Company, New Delhi, 2009.

15NN02/15NB02 OBJECT ORIENTED PROGRAMMING

2 2 0 3

INTRODUCTION: Object oriented programming concept**s**, Data types, Variables, Arrays, Operators, Control statements, Methods and classes, Inheritance, Packages, Interface, Exception, User defined and predefined exception handling, Multithreading.

(6+6)

JAVA LIBRARY: String handling, Java utilities package and collections.   (6+6)

INPUT/OUTPUT: Files, Streams, Stream tokenizer, Serialization.   (6+6)

EVENT HANDLING: Delegation event model - Event classes - Sources of events - Event listener, AWT classes, Swings, Frames, Graphics, Color, Font, Controls, Layout managers, Menus.   (6+6)

DATABASE AND SOCKET PROGRAMMING: Java networking: Sockets, RMI, JDBC.   (6+6)

Total L:30+T:30=60

REFERENCES:
1.   Patrick Naughton and Herbert Schildt, "Java 2 - The Complete Reference", McGraw Hill, New Delhi, 2008.
2.   Deitel H M and Deitel P I, "Java - How to Program", Pearson Education, New Delhi, 2008.
3.   Hubbard John R, "Schaum's Outline of Theory and Problems of Programming with Java", McGraw Hill, New Delhi, 2006.
4.   Balagurusamy, "Programming with JAVA", McGraw Hill, New Delhi, 2009.
5.   Bruce W. Perry, "Java Servlet and JSP Cookbook", O'Reilly Media, New Delhi, 2004.

15NN03/15NB03   DATA STRUCTURES AND ALGORITHMS

3 0 0 3

INTRODUCTION: Primitive data types, Abstract data types, Arrays, Linked lists, Stacks and queues, Applications, Hash tables, Collision resolution. (9)

TREES AND GRAPHS: Binary trees, Tree traversals, Binary search trees, AVL trees, B and B+ trees, Binary heap, Representation of graphs, Breadth first search, Depth first search, Dijkstra's and Bellman Ford's algorithms, Floyd - Warshall's all pair shortest paths algorithm. (9)

COMPLEXITY ANALYSIS: Algorithm analysis, Asymptotic notations and basic efficiency classes, Mathematical analysis of non-recursive and recursive algorithms, Time and space complexity, Algorithm design methods. (5)

DIVIDE AND CONQUER: Binary search analysis, Quick sort analysis, Merge sort analysis. (5)

GREEDY AND DYNAMIC PROGRAMMING: Knapsack problem, Minimum spanning trees: Prim's algorithm - Kruskal's algorithm, Optimal storage on tapes, Dynamic Programming- Multistage graphs, 0/1 knapsack problem, Travelling salesman problem. (9)

BACKTRACKING, BRANCH AND BOUND: N-queens problem, Graph coloring, Hamiltonian cycles, Knapsack problem, Branch and bound - 0/1 knapsack problem, Travelling salesman problem. (8)

Total L: 45

REFERENCES:
1. Weiss M A, "Data Structures and Algorithm Analysis in C", Addison Wesley, New Delhi, 2007.
2. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Computer Algorithms", Computer Science Press, New Delhi, 2008.
3. Thomas H Cormen et al., "Introduction to Algorithms", Prentice Hall, New Delhi, 2009.
4. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, New Delhi, 2011.
5. Vijayalakshmi Pai, "Data Structures Concepts, Techniques and Applications", Tata McGraw Hill, New Delhi, 2008.

15NN04/15NB04   NETWORKING TECHNOLOGY

3 2 0 4

INTRODUCTION: Computer networks and Internet, The network edge, The network core, Delay and Loss, Protocol layers and services. (5+5)

APPLICATION LAYER PROTOCOLS: HTTP, FTP, SMTP, DNS, Peer-to-Peer Applications, Socket programming. (9+5)

TRANSPORT LAYER: Services, UDP: Datagram-Services-Applications, TCP: Services-Segment-Connection-Windows-Flow control-Error control- Congestion control-Timer. (7+5)

NETWORK LAYER: Services, Virtual circuit and Datagram networks, IP: Datagram-IP4 Addressing-ICMP, IPv6 Addressing, Routing Algorithms, Routing in the Intranet, Broadcast and Multicast routing (8+5)

LINK LAYER: Services, Error detection and correction, Multiple access protocols, ARP, Ethernet, Hubs, Bridges, Switches, Point-to- point Protocol. (8+5)

MULTIMEDIA NETWORKING: Applications, Streaming stored audio and video, Real-time interactive protocols: RTP-RTCP-SIP-H.323. (8+5)

Total L:45+T:30=75

REFERENCES:
1. William Stallings, "Data and Computer Communications", Prentice Hall, New Delhi, 2013.
2. Behrouz A Forouzan, "Data Communications and Networking", Tata Mc-Graw Hill, New Delhi, 2013.
3. James F Kurose and Keith W.Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Addison Wesley, New Delhi, 2013.
4. William Fitzgerald and Dennis, "Business Data Communications and Networking", John Wiley and Sons, New Delhi, 2009.

5.   Christian Benvenuti, "Understanding Linux Network Internals", O'Reilly Publishers, USA, 2006.

15NN05 DATABASE TECHNOLOGIES

3 2 0 4

INTRODUCTION: Purpose of Database System, File System versus DBMS, Views of Data, Data Models, Database System Architecture, ER Diagrams, Extended ER Diagrams, Reduction to relational schemas.   (7+5)

RELATIONAL DBMS: Introduction to the Relational Model: Structure of Relational Databases, Keys, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, SQL Fundamentals: DDL-DML-DCL-TCL– Views –Joins-Nested Queries-Embedded SQL.   (7+5)

DATABASE DESIGN: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, Boyce-Codd Normal Form, Relational Database Design Algorithms and Further Dependencies: Multivalued Dependency, Join Dependency.   (8+5)

DATA STORAGE AND INDEXING: Introduction, Record Storage, Primary File Organization, Index Structures for files: Single level Indexing-Multilevel Indexing.   (8+5)

TRANSACTION MANAGEMENT AND QUERY OPTIMIZATION: Properties of Transaction, Serializability, Concurrency Control ,Locking Mechanisms, Two Phase Commit Protocol, Deadlock, Query Processing, Heuristics of Query Optimization, Cost Based Query Optimization.   (5)

TRENDS IN DATABASE TECHNOLOGY: Client Server Technology, Distributed Databases, Multimedia Databases, Mobile and Web Databases, XML and Databases, Introduction to Non-RDBMS, Different Databases used in Non-RDBMS.   (7+5)

Total L:45+T:30=75

REFERENCES:
1.   Ramez Elmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Pearson Education, New Delhi, 2010.
2.   Abraham Silberschatz, Henry F Korth and Sudharshan S, "Database System Concepts", Tata McGraw Hill, New Delhi, 2010.
3.   Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2009.
4.   Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill, New Delhi, 2003.
5.   Gupta G K, "Database Management Systems", Tata McGraw Hill, New Delhi, 2011.
6.   Judith Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman, "Big Data for Dummies", Wiley Publication, New Delhi, 2013.

15NN51 /15NB51   DATA STRUCTURES LABORATORY

0 0 4 2

1.   Stacks and queues
2.   Evaluation of postfix expressions
3.   Double ended queues
4.   Singly and doubly linked lists
5.   Binary search trees
6.   File handling using B+ and AVL trees
7.   Graph Traversals – Breadth first search and Depth first search
8.   Collision resolution techniques
9.   Single source shortest path algorithm – Dijkstra`s algorithm
10.   All pairs shortest path algorithm – Floyd Warshall's algorithm
11.   Graph coloring

Total P:60

15NN61 INDUSTRY VISIT AND TECHNICAL SEMINAR

The student will make atleast two technical presentations on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of the semester covering the various aspects of his/her presentation together with the observation in industry visits. A quiz covering the above will be held at the end of the semester.

Total P :30

SEMESTER II

15NN06 OPERATING SYSTEMS

3 2 0 4

INTRODUCTION: Operating system overview, Services, Types of operating systems, Operating systems structures.   (6+5)

PROCESS MANAGEMENT: Processes, Threads, CPU scheduling approaches, Interprocess communication, Process synchronization, Deadlocks: Characterization, Methods for handling deadlocks.   (8+5)

MEMORY MANAGEMENT: Contiguous memory allocation, Swapping, Paging, Segmentation, Segmentation with paging, Virtual memory: Demand paging, Page replacement algorithms, Allocation of frames, Thrashing.   (8+5)

FILE HANDLING: File concepts, Access methods, Directory structure, File system mounting, File sharing, File protection, File system implementation: File system   structure and implementation-Directory implementation-Allocation methods-Free space management-Recovery.   (8+5)

I/O SYSTEMS: I/O hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O to hardware operations, Disk structure, Disk scheduling, Disk management, Swap space management, RAID structure.   (7+5)

CASE STUDY: Linux, Windows, Android, iOS: Architecture – Features – Process Management – Memory Management – File Systems.   (8+5)

Total L:45+T:30=75

REFERENCES:
1. Silberschatz A, Galvin P and Gagne G, "Operating Systems Concepts", John Wiley and Sons, New York, 2013.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, New Delhi, 2014.
3. Deitel H M, "Operating System", Pearson Education, New Delhi, 2011.
4. Andrew S Tanenbaum, Albert S Woodhull, "Operating Systems Design and Implementation", Pearson Education, New Delhi, 2006.
5. Charles Crowley, "Operating systems: A Design Oriented Approach", Tata McGraw Hill, New Delhi, 2009.
6. Daniel P Bovet, Marco Cesati, "Understanding the Linux Kernel", O'Reilly Publishers, USA, 2006.

15NN07 DATA MINING

3 0 0 3

INTRODUCTION: Data Mining Tasks, Issues, Functionalities, Kinds of Data to be Mined, Kinds of Patterns to be Mined, Technologies, Applications –Intrusion Detection, Financial Data Analysis, Recommender Systems. Data Preprocessing: Data Cleaning - Data Integration - Data Reduction - Data Transformation and Discretization.   (8)

ASSOCIATION MINING: Frequent Item Set Mining Methods: Apriori Algorithm - Pattern Growth Approach - Pattern Evaluation Methods, Mining Multilevel and Multidimensional Association.   (8)

CLASSIFICATION: General Approach, Decision Tree Induction, Bayes Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Classifier Evaluation.   (9)

CLUSTER ANALYSIS: Partitioning Methods: K- Means Method – K- Medoid Method, Hierarchical Methods: Agglomerative Methods, Divisive Methods, BIRCH, Chameleon, Density Based Methods, Evaluation of Clustering.   (7)

OUTLIER DETECTION: Outlier Analysis, Detection Methods, Statistical and Proximity based approaches. (5)

WEB MINING: Introduction, Crawling the Web, Web Search and Information Retrieval, Similarity Clustering. (8)

Total L: 45

REFERENCES:
1. Jaiwei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Elsevier, New Delhi, 2012.
2. Pang-Ning Tan and Michael Steinbach, "Introduction to Data Mining", Addison Wesley, New Delhi, 2013.
3. Mehmed Kantardzic, "Data Mining: Concepts, Models, Methods and Algorithms", John Wiley and Sons, New Jersey, 2011.
4. Soumen Chakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", Morgan Kaufman Publishers, New Delhi, 2005.
5. Margaret Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, New Delhi, 2011.
6. Rajan Chattamvelli, "Data Mining Methods", Narosa Publishers, New Delhi, 2011.

15NN08 CLOUD COMPUTING

3 0 0 3

INTRODUCTION: Basics of distributed concepts, Grid computing: Architecture - Virtual organization - Web services vs grid services, Grid vs cloud computing, Roots of cloud computing , Deployment models, Service models, Refactoring. (7)

VIRTUALIZATION: Types, Provisioning and manageability, Migration, Provisioning in the cloud context, Management of virtual machine: Anatomy of cloud infrastructures - Scheduling techniques for advance reservation of capacity, Study on virtualization tool, Linux Container. (9)

CLOUD SERVICES: Software-as-a-service (SaaS) concepts, Tools, Platform-as-a-service (PaaS) concepts, Infrastructure as a service (IaaS) concepts. (4)

MAP REDUCE PARADIGMS: Introduction, GFS architecture, HDFS architecture, Hbase, Google big table, Amazon web services (AWS), Amazon's (key value) pair storage and Microsoft's Azure infrastructure, Map reduce: Programming model and implementations, NoSQL Database. (9)

CLOUD SECURITY AND MONITORING: Common threats and vulnerabilities, Access control issues, Service provider risks, Virtualization security management, Identity management, Migration into a cloud, Federated cloud computing, SLA management: Types - Lifecycle - Automated policy management in cloud. (9)

APPLICATION DEVELOPMENT: Application creation using Jelastic, Cloudsim, Google App Engine, Microsoft Windows Azure, Cloudera, Case Study: Aneka – Eucalyptus – OpenStack. (7)

Total L:45

REFERENCES:
1. Adam Jorgensen, James Rowland – Jones, John Welch, Dan Clark, Christopher Price and Brian Mitchell,"Microsoft Big Data Solutions", Wiley, New Delhi, 2014.
2. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley and Sons, New Jersey, 2011.
3. Michael Miller, "Cloud Computing, Pearson Education", New Delhi, 2011.
4. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata McGraw Hill, New Delhi, 2010.
5. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", Wiley India, New Delhi, 2010.
6. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, USA, 2012.

15NN09 SOFTWARE ENGINEERING METHODOLOGIES

INTRODUCTION: Software process, Software engineering practice, Process models: Waterfall model – Prototyping -Rapid Application Development Model– Incremental model – Winwin spiral model, Agile: Development primer – Characteristics – Methodology – Practices. (9)

REQUIREMENTS: Requirements engineering, Feasibility study, Software Requirement Specification, Requirements elicitation and analysis, Requirements validation, Requirements management, Analysis modeling. (8)

DESIGN: Design concepts, Design model, Data Flow Diagram, Architectural design, Designing class based components, User interface design, Design patterns. (9)

PROGRAMMING STANDARDS: Structured programming, Coding standards, Maintainability of programs, Reactive Programming. (5)

SOFTWARE TESTING: Testing fundamentals, Test cases, Testing techniques: Black box testing – White box testing, Basis path testing, Control structure testing, Testing strategies: Unit testing – Integration testing – Validation testing – System testing, Art of debugging. (6)

SOFTWARE CONFIGURATION MANAGEMENT AND MAINTENANCE: SCM process, Version control, Change control, Configuration audit, SCM standards, Software maintenance: Types of changes, Maintenance issues, Measuring maintenance effort, Proactive, Preventive and Perfective maintenance, Software rejuvenation. (8)

Total L:45

REFERENCES:
1. Roger Pressman, S, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill, New Delhi, 2010.
2. Sommerville I, "Software Engineering", Pearson Education, New Delhi, 2012.
3. Shari Lawrence Pfleeger, "Software Engineering: Theory and Practice", Pearson Education, New Delhi, 2014.
4. Pankaj Jalote, "Integrated Approach to Software Engineering", Springer, New York, 2010.
5. Peter Schuh, "Integrating Agile Development in the Real World", Cengage Learning, USA, 2005.

15NN10 MOBILE COMPUTING

3 0 0 3

PHYSICAL AND MAC LAYER: Frequencies for radio transmission, Signals, Signal propagation, Multiplexing: SDM – FDM –TDM – CDM, Modulation: ASK – FSK – PSK, Spread spectrum, Cellular systems, MAC: SDMA – FDMA – TDMA – CDMA – Comparison of S/F/T/CDMA. (8)

ROUTING IN ADHOC NETWORKS: Introduction, Topology based versus position based approaches, Topology based routing protocols: Proactive – Reactive – Hybrid – Comparison, Position based routing: Principles and issues - Location services - Forwarding strategies - Comparisons, Power aware routing, QOS routing. (7)

SENSOR NETWORKS DESIGN CONSIDERATIONS: Overview, Sensing and communication range, Design issues, Localization scheme, Clustering of sensor nodes, MAC layer, Routing layer: Energy aware routing – CBRP – LEACH - Location based routing, High level application support. (8)

NETWORK AND TRANSPORT LAYER: Mobile IP: Goals and requirements - IP packet delivery - Agent discovery – Registration - Tunneling and encapsulation - Reverse tunneling - IPV6, Traditional TCP, Classical TCP improvements: Indirect TCP – Snooping TCP – Mobile TCP – Fast retransmit/ Fast recovery – TCP over wireless networks. (8)

MOBILE OPERATING SYSTEMS: Platform Architecture: Windows CE - Linux for mobile devices – Android – iOS – Windows phone 7, Mobile device programming, The application life cycle. (7)

MOBILE APPLICATION DEVELOPMENT: Overview of Mobile Devices, Types, Mobile Web applications versus native applications, Transport and Internet Protocols for mobile applications, Constraints, Developing Mobile Apps: Android devices - iOS devices. (7)

Total L:45

REFERENCES:

1. Jochen Schiller, "Mobile Communication", Pearson Edition, New Delhi, 2013.
2. Morais and Agrawal, "Adhoc and Sensor Networks", World Scientific, Singapore, 2011.
3. Asoke K Talukder, Hasan Ahmed and Roopa R Yavagal, "Mobile Computing – Technology, Applications and Service Creation", Tata McGraw Hill, New Delhi, 2011.
4. Thomas J Duffy, "Programming with Mobile Applications: Android, iOS and Windows Phone 7", Cengage Learning, USA, 2013.
5. James C Sheusi, "Android Application Development for JAVA Programmers", Cengage Learning, USA, 2013.

15NN52 SOFTWARE DEVELOPMENT LABORATORY

0 0 4 2

1. Working with Cloudsim
2. Realize Platform as a Service: JElastic
3. Realize Software as a Service
4. Study of Hadoop: Hadoop Environment setup
5. Implementation of MapReduce in Hadoop
6. Building application using Docker
7. Realize Infrastructure as a Service: Virtualbox + Openstack
8. Study of VMware

P:60

SEMESTER III

15NN53 APPLICATION DEVELOPMENT LABORATORY

0 0 4 2

1. 3D Game with Custom Behaviors
2. Hospital Management System Using Beans in Forte for Java Community Edition
3. Bookstore Using Servlet / JSP
4. Student Result Management System using .Net
5. Inventory Control using C#. Net
6. Mini Project

Total P:60

15NN71 PROJECT WORK - I

0 0 6 3

- Identification of a real life problem in thrust areas
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Proposing different solutions for the problem based on literature survey
- Future trends in providing alternate solutions
- Consolidated report preparation of the above

Total P: 90

SEMESTER IV

15NN72 PROJECT WORK - II

0 0 28 14

The project involves the following:

Preparing a project – brief proposal including

- Problem Identification
- A statement of system / process specifications proposed to be developed (block   Diagram / Concept tree)

- Cost benefit analysis
- Time Line of activities

A report highlighting the design finalization [based on functional requirements & standards (if any)]

A presentation including the following:
- Implementation Phase (Hardware / Software / both)
- Testing & Validation of the developed system
- Learning in the project

Consolidated report preparation

Total P:420

ELECTIVE THEORY COURSES
(Six to be opted out of which two may be an open elective from other M.E/M.Tech programmes)

15NN21 XML AND WEB SERVICES

3 0 0 3

XML: Fundamentals of XML, Document Type Definition, XML Schema, Validating documents against schemas, Basics of namespace, JSON. (6)

XML TECHNOLOGIES: Presentation: XSL – XFORMS, Transformation, XSLT, XLINK, Xpath, XQuery, Integrating XML with databases, XML Security. (6)

ARCHITECTING WEB SERVICES: Business Motivations for Web Services, Technical Motivations for Web Services, Service-Oriented Architecture (SOA), Web Services Technology Stack, Composition of Web Services, From Application Servers to Peer-to-Peer, Life in the Runtime. (7)

WEB SERVICE TECHNOLOGIES: Simple Object Access Protocol (SOAP): SOAP Envelope - Head - Body - Fault - Sending SOAP messages, RESTful Web services, Web Service Definition Language (WSDL): WSDL Document Structure, SOAP Binding, Federated databases, Federation technologies. (11)

TRANSACTION PROCESSING IN WEB SERVICES: Transactions, Travel Agent Scenario: Using Atomic Transaction and Business Activity - Web service security. (8)

XML AND CONTENT MANAGEMENT: Architecture of semantic web, Role of metadata in web content, Resource Description Framework (RDF), RDF schema. (7)

Total L: 45

REFERENCES:
1. Ron Schmelzer et al., "XML and Web Services Unleased", Pearson Education, New Delhi, 2012.
2. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP and UDDI", Pearson Education, New Delhi, 2002.
3. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, New Delhi, 2004.
4. Leonard Richardson and Sam Ruby, "RESTful Web Services Web Services for the Real World", O'Reilly Publishers, Orlando, 2008.
5. Sanjiva Weerawarana et al., "Web Services Platform Architecture", Prentice Hall, New Delhi, 2005.

15NN22 SERVICE ORIENTED ARCHITECTURE

3 0 0 3

INTRODUCTION: Service governance, Processes, Guidelines, Principles, Methods and tools, Key service characteristics, Technical benefits of a Service Oriented Architecture (SOA). (6)

SOA IN WEB SERVICES: Introduction to XML technologies, Document Type Definition, XML Schema Definition, Universal Description Discovery and Integration, Simple Object Access Protocol APIs, Web Service Definition Language, Extensions for binding to SOAP, SOAP: Specification - Message processing - Namespaces - Multipart MIME attachments. (12)

BUSINESS PROCESS MANAGEMENT: Process modeling, Process execution, Process monitoring, Business activity monitoring, Combining BPM, SOA and Web Services (WS), Orchestration and choreography specifications, Simple approach to metadata management, Case Study: RailCo Ltd, Transit Line Systems Inc. (7)

SOA PLATFORM: SOA support in J2EE, Java API for XML based WS, Java Architecture for XML Binding, Java API for XML Registries, Java API for XML Based RPC, XAML, JAX RPC, WS Interoperability Technologies, SOA Support in .NET: Common Language Runtime - ASP.NET web forms - ASP.NET web services - WS Enhancements. (12)

WEB SERVICES SECURITY: WS overarching concern, Core concepts, Challenges, Threats and remedies, Securing the communication layer, Message level security, WS security framework, WS security policy, WS trust, WS secure conversation, Data level security, XML encryption, XML signature. (8)

Total L: 45

REFERENCES:
1. Greg Lomow and Eric Newcomer, "Understanding SOA with Web Services", Pearson Education, New Delhi, 2009.
2. Michael Rosen, et al, "Applied SOA: Service Oriented Architecture and Design Strategies", John Wiley and Sons, UK, 2012.
3. Thomas Erl, "Service - Oriented Architecture: Concepts, Technology and Design", Prentice Hall, New Delhi, 2008.
4. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP and UDDI", Addison Wesley, USA, 2004.
5. Thomas Erl,et al, "SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST", Prentice Hall, 2012.
6. Chatterjee, Sandeep and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, New Delhi, 2005.

15NN23 CRYPTOGRAPHY AND NETWORK SECURITY

3 0 0 3

INTRODUCTION: Computer security concepts, OSI security architecture, Security attacks, Security services, Security mechanisms, Model for network security, Cryptography and modern cryptography, Setting of private key encryption, Historical ciphers and their cryptanalysis. (5)

SYMMETRIC CIPHERS: Symmetric cipher model, Substitution techniques, Transposition techniques, Block cipher principles, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Multiple encryption, block cipher modes of operation, Use of random numbers, Pseudorandom number generators, Stream ciphers, RC5. (11)

ASYMMETRIC TECHNIQUES: Public key cryptosystems, RSA algorithm, Key management and distribution, Diffie Hellman key exchange, Elliptic Curve Cryptography. (9)

CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS: Message Digest algorithm MD5, Secure Hash Algorithm, Message Authentication Codes, Digital Signature Standard. (8)

WEB SECURITY: Pretty Good Privacy, IP Security architecture, Web security, Secure socket layer, Transport layer security, HTTPS. (7)

INTRUSION DETECTION SYSTEM AND FIREWALLS: Viruses and related threats – Worms – Intruders - Intrusion detection system, Firewalls: Firewall design principles - Firewall configurations. (5)

Total L:45

REFERENCES:
1. William Stallings, "Cryptography and Network Security", Prentice Hall, New Delhi, 2011.
2. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, New Delhi, 2010.
3. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security Tata McGraw Hill", New Delhi, 2011.
4. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2008.
5. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography", Chapman and Hall/CRC, New York, 2007.

15NN24 INFORMATION STORAGE MANAGEMENT

3 0 0 3

INTRODUCTION: Information storage, Evolution of storage architecture, Data center infrastructure, Information lifecycle management, Virtualization, Data center environment: Application - DBMS - Host - Connectivity - Storage - Disk drive components - Disk drive performance - DAS, RAID: Implementation methods - Techniques - Levels - RAID impact on Disk performance, Intelligent storage system: Components - Storage provisioning – Types. (9)

FC SAN AND IP SAN: FC SAN: Overview - SAN and its evolution - Components - FC connectivity - Switched fabric ports - FC architecture - Fabric services - Zoning - FC SAN topologies - Virtualization in SAN, IP SAN: iSCSI - FCIP - FCOE. (8)

NAS AND CAS: NAS: Overview - Benefits - File systems - Components - I/O operations - Implementations - File sharing protocols - Factors affecting NAS performance - File level virtualization, Object based and unified storage: Object based storage devices - CAS - Use cases - Unified storage. (8)

BACKUP, ARCHIVE AND REPLICATION: Business continuity: Information availability - Terminology - Planning lifecycle - Technology solutions, Backup and archive: Backup purpose - Methods - Architecture - Backup and restore operations - Topologies - Backup in NAS - Archiving solution architecture, Local Replication: Replication terminology - Uses - Replica consistency - Technologies - Tracking changes, Remote replication: Modes - Technologies. (8)

SECURING THE STORAGE INFRASTRUCTURE: Information security framework, Risk triad, Storage security domains, Security implementations in storage networking, Securing storage infrastructure in virtualized and cloud environments . (6)

CLOUD COMPUTING: Introduction, Cloud storage, Technologies for data security in cloud computing: Database outsourcing and query integrity assurance - Data integrity in untrustworthy storage - Web application based security. (6)

Total L:45

REFERENCES:
1. Somasundaram G and Alok Shrivastava, "Information Storage and Management, EMC Education Services", Wiley India, New Delhi, 2012.
2. James A. O'Brien, George M. Marakas and Ramesh Behl, "Management Information Systems", McGraw Hill Education, New Delhi, 2013.
3. Gerald J Kowalski and Mark T Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", BS Publications, New Delhi, 2009.
4. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud computing Principles and Paradigms", Wiley India Private Ltd., New Delhi, 2014.

15NN25 MACHINE LEARNING

3 0 0 3

INTRODUCTION: Definition of learning systems, Goals and applications of machine learning, Aspects of developing a learning system: Training data, Concept representation, Function approximation. (6)

SUPERVISED LEARNING: Linear Models for Classification, Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, Bayesian Logistic Regression, Decision Trees - Classification Trees, Regression Trees, Pruning, Ensemble methods, Bagging, Boosting. (8)

ARTIFICIAL NEURAL NETWORKS: Neurons and biological motivation, Linear threshold units, Perceptrons: Representational limitation and gradient descent training, Multilayer networks and backpropagation, Hidden layers and constructing intermediate, Distributed representations. (8)

TEXT CLASSIFICATION: Bag of words representation, Vector space model and cosine similarity, Versions of nearest neighbor, Naive Bayes for text, Support Vector Machines: Maximum margin linear separators. (8)

CLUSTERING AND UNSUPERVISED LEARNING: Learning from unclassified data, Clustering, Hierarchical Agglomerative Clustering, k-means partitional clustering, Expectation maximization (EM) for soft clustering, Semi-supervised learning with EM using labeled and unlabeled data. (8)

ADVANCED LEARNING: Sampling: Basic sampling methods - Monte Carlo, Reinforcement Learning: K-Armed Bandit – Elements, Model based Learning: Value Iteration-Policy Iteration, Semi-Supervised Learning, Computational Learning. (7)

Total L: 45

REFERENCES:

1. Abu-Mostafa Y S, Magdon-Ismail M and Lin H T, "Learning from Data", AML Book Publishers, USA, 2012.
2. Murphy K P, "Machine Learning: A Probabilistic Perspective", MIT Press, USA, 2012.
3. Bishop C M, "Pattern Recognition and Machine Learning", Springer, USA, 2007.
4. Mohri M, Rostamizadeh A, and Talwalkar A, "Foundations of Machine Learning", MIT Press, USA, 2012.
5. Mitchell T M, "Machine Learning", McGraw Hill, USA, 1997.

15NN26 EVOLUTIONARY COMPUTATION

3 0 0 3

INTRODUCTION: Fundamentals of optimization, Principles of Evolutionary Processes and Genetics, History of Evolutionary Computation. (4)

COMMON METHODS: Genetic algorithms, Evolution strategies, Evolution programming, Genetic programming, Classifier systems, Swarm Intelligence. (8)

BASIC DATA STRUCTURES AND OPERATORS: Genetic Representation, Search operators, Selection schemes, Selection pressure and its impact on evolutionary search**.** (8)

ADVANCED FEATURES: Constraint handling, Co-evolution and speciation, Parameter Adaptation and Control. (8)

EVOLUTIONARY COMPUTATION APPROACHES: Evolutionary multi-objective optimization, Parallel evolutionary algorithms, Dynamic optimization, Hybrid evolutionary algorithms. (9)

APPLICATIONS: Knapsack problem, Minimum spanning tree, Travelling Salesman Problem, Scheduling, Robotics and automation, Inventory Control. (8)

Total L: 45

REFERENCES:
1. Xinjie Yu and Mitsuo Gen, "Introduction to Evolutionary Algorithms", Springer, New York, 2010.
2. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, "Particle Swarm Optimization: Classical and Quantum Perspectives", Taylor and Francis, USA, 2012.
3. Carlos A Coello Coello, Gary B Lamont and David A Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-Objective Problems", Springer, New York, 2007.
4. Back T, D. B. Fogel and Z. Michalewicz, "Evolutionary Computation 1: Basic Algorithms and Operators", Taylor and Francis Group, New York, 2000.
5. Back T, D. B. Fogel and Z. Michalewicz, "Evolutionary Computation 2: Advanced Algorithms and Operators", Taylor and Francis Group, New York, 2000.
6. Thomas Back, "Evolution Strategies, Evolutionary Programming Genetic Algorithms", Oxford University Press, New York, 1996.

15NN27 BIG DATA ANALYTICS

3 0 0 3

INTRODUCTION: Overview of Big Data, Stages in analytical evolution, State of the practice in analytics, the data scientist, Fraud detection patterns - Risks, Implications for information management, Big Data architecture Characteristics, Data quality, Data security and privacy constraints Case Study: Big Data and The Energy Sector - IBM for Big Data. (8)

ANALYTICS PROCESS: Evolution of analytic scalability, Analytic processes: Analytic sandbox – Analytic dataset – Analytic tools and methods, Analysis and reporting, Core analytics versus advanced analytics, Framing the problem, Statistical significance versus business importance, Making inferences versus Computing Statistics. (7)

PIG, HBASE AND HIVE: Pig Latin, User Defined Functions, Data Processing Operators, Hbasics, Installation, Clients, Examples, HbaseVs RDBMS, Zookeeper and its Service, Hive: Characteristics of Hive – System Architecture – Components of Hive – Hive Data Models. (8)

STORM: Components and properties of storm, Storm topologies: Stream grouping – DRPC topologies – Distributed word count. (6)

R LANGUAGE: Introduction to R, Programming structures: Control statements - Operators - Functions - Environment and scope issues - Recursion - Replacement functions, R data structures: Vectors -   Matrices and arrays - Lists - Data frames - Classes, Input/output, String manipulations, Programming structures, Interfacing R to other languages. (9)

MONGODB: Mongo DB Basics, Optimization, Replication, Sharding.   (7)

REFERENCES:
1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, USA, 2012.
2. Jonathan Leibiusky, Gabriel Eisbruch and Dario Simonassi, "Getting Started with Storm", O'Reilly Publishers, USA, 2012.
3. Taylor Goetz P. and Brian O'Neill, "Storm Blueprints: Patterns for Distributed Realtime Computation", Packt Publishers, Mumbai, 2014.
4. EelcoPlugge, Tim Hawkins, Peter Membrey, "The Definitive Guide to Mongodb: The NoSQLl Database for Cloud and Desktop Computing", Apress, USA, 2010.
5. Norman Matloff, "The Art of R Programming", No Starch Press, San Francisco, 2011.
6. Paul Zikopoulos, Chris Eaton, Dirk Deroos, Thomas Reutch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", Mc Graw Hill Professional, New Delhi, 2011.

15NN28 SOCIAL NETWORK ANALYSIS

3 0 0 3

INTRODUCTION: Introduction to Semantic Web, Limitations, Development of Semantic Web, Emergence of the Social Web, Network analysis: Development of Social Network Analysis, Blogs and Online communities, Web based Networks.   (9)

GRAPH THEORY AND SOCIAL NETWORKS: Overview, Graphs, Strong and Weak Ties, Game Theory: Evolutionary Game Theory, Modeling Network Traffic using Game Theory, Auctions.   (10)

SOCIAL NETWORKING AND WEB RECOMMENDATION: Evolution of Web Community, Temporal Analysis, Analysis of communities, Socio Science, Web Mining and Recommendation Systems.   (8)

ONLINE SOCIAL NETWORK PRIVACY ISSUES: Online Social Networks, Types of Privacy Disclosure, Statistical Methods, Data Publishing and Privacy Preserving Mechanisms: Anonymity and Differential Privacy, Attacks and Privacy Preserving Mechanisms.
          (8)

SOCIAL NETWORK APIS: OpenSocial APIs, Twitter OAuth, Twitter APIs, Facebook APIs, XFBML, Google Friend Connect Javascript APIs.   (7)

CASE STUDY: Opinion mining - Sentiment analysis - Trend analysis - Emerging Trends in Social Networks and Media.   (3)

REFERENCES:
1. Peter Mika, "Social Networks and the Semantic Web", Springer, New York, 2007.
2. David Easley and Jon Kleinberg , "Networks, Crowds, and Markets: Reasoning about a Highly Connected World Cambridge University Press", New Delhi, 2010.
3. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, New York, 2011.
4. Elena Zheleva, Evimaria Terzi, Lise Getoor, "Privacy in Social Networks", Morgan and Claypool, USA, 2012.
5. Mark D. Hawker, "Developer's Guide to Social Programming: Building Social Context Using Facebook, Google Friend Connect, and the Twitter API, The Developer's Library", Pearson, Boston, 2010.
6. Ajith Abraham,Aboul-ella hassanien,Vaclav Snasel, "Computational Social Network Analysis", Springer, New York, 2009.

15NN29 AGENT BASED INTELLIGENT SYSTEMS

3 0 0 3

INTRODUCTION: Agents and Objects, Evaluation of Agents, Agent Design Philosophies, Multi-Agent System, Mobile Agents, Agent Communication, Knowledge Query and Manipulation Language, Intelligent Agents, Agents and Environments, Structure of Agents. (8)

PROBLEM SOLVING AGENTS: Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Online Search Agents and Unknown Environments, Constraint Satisfaction Problems. (9)

KNOWLEDGE BASED AGENTS: Knowledge Representation, Logic, Proposition, Inference, First Order Logic, Inference in FOL, Algorithms, Knowledge Representation Issues. (8)

PLANNING: Planning Problem, Partial Order Planning, Conditional Planning, Multi Agent Planning. (7)

PROBABILISTIC AGENTS: Uncertainty and Probabilistic Reasoning, Communicative Agents, Probabilistic Agents. (6)

LEARNING AGENTS: Learning from Observations, Learning Decision Trees, Statistical Learning Methods, Instance based Learning, Neural Network Techniques for Learning. (7)

Total L: 45

REFERENCES:
1. Stuart Russel, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education Ltd, Edinburg, 2009.
2. Padhy N P, "Artificial Intelligence and Intelligent Systems", Oxford University Press, New Delhi, 2005.
3. Nils J Nilsson, "Artificial Intelligence – A New Synthesis", Morgan Kaufmann, New Delhi, 2007.
4. George F Luger, "Artificial Intelligence – Structures and Strategies for Complex Problem Solving", Pearson Education, New Delhi, 2009.

15NN30 SEMANTIC WEB

3 0 0 3

SEMANTIC WEB: Current web, Transition to the semantic web, Technologies, Goals, Developing the semantic web, Layered approach. (6)

LANGUAGES FOR SEMANTIC WEB: XML language, Structuring, Addressing and querying XML documents, Processing, RDF: RDF schema - An axiomatic semantics for RDF and RDF schema, Traditional ontology languages: SHOE - UPML - OIL language constructs - DAML + OIL - OWL – SPARQL, Parser: SAX, DOM. (11)

ONTOLOGY ENGINEERING: Classification, Constructing ontologies manually, Reusing existing ontologies, Semiautomatic ontology acquisition, Mapping, Exposing relational databases. (10)

ONTOLOGY KNOWLEDGE MANAGEMENT: Requirement for ontology management, Topic ontologies vs Schema ontologies, Proton ontology (4)

TOOLS: Dublin Core Meta Editor - OilEd - OntoEdit - Protege Ontology Editor. (6)

APPLICATIONS: Applying semantic technology to a Digital Library, Supply Chain Management, Media Management, Data Integration, Web Search and E-commerce. (8)

Total L: 45

REFERENCES:
1. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, USA, 2012.
2. John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology – Driven Knowledge Management", John Wiley and Sons, England, 2003.
3. Dieter Fensel et al, "Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential", MIT Press, USA, 2005.
4. John Davies, Rudi Studer and Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley Publications, England, 2006.
5. Karin K Breitman, Marco Antonio Casanova and Walter Truszkowski, "Semantic Web: Concepts, Technologies and Applications", Springer-Verlag, London, 2009.

15NN31 NETWORK DESIGN

3 0 0 3

INTRODUCTION: Building a network, Applications, Requirements, Network architecture, Performance, pperspectives on connecting, Wireless networks, Basic internetworking (IP), Need for network design. (6)

WAN DESIGN: Management overview of WAN network design, Technical overview, Centralized network design, Distributed network design, Star, Tree, Backbone, Mesh, Value Added Network Design. (9)

LAN DESIGN: Management overview, IEEE LAN standards, Ethernet LANs, Wireless LANs, Similarities and differences, LAN design and planning, Criteria, Performance indicators, Information sources, LAN visualization instruments: netViz - LAN Planning and Design Tools. (9)

INTRANET: Intranet planning and management, Technical overview: Basic terminology – Components – Implementation – Deployment. (6)

CLIENT SERVER AND DISTRIBUTED NETWORKING: Overview of Client / Server concepts, Two and three tier architectures, N - Tier distributed object architectures, Middleware functions and implementations, Middleware standards. (7)

TECHNICAL CONSIDERATIONS IN NETWORK DESIGN: Overview, Data collection, Technical requirement specification, Greedy algorithm, Computational complexity analysis, Network design techniques, Performance analysis, Queueing essentials, Analysis of loss and delay in networks: M/M/1 model – M/M/1/k model - M/G/1 model. (8)

Total L: 45

REFERENCES:
1. Larry L. Peterson, Bruce S. Davie, "Computer Networks – A Systems Approach", Elsevier, USA, 2011.
2. Teresa C.Piliouras, "Network Design Management and Technical Perspectives", CRC Press, USA, 2005.
3. Petrica C. Pop, "Generalized Network Design Problems: Modeling and Optimization", DeGruiter, Germany, 2011.
4. Al-Bahadili, Hussein, "Simulation in Computer Network Design and Modeling: Use and Analysis: Use and Analysis", IGI Global, 2012.

15NN32 WIRELESS NETWORKS

3 0 0 3

WIRELESS WIDE AREA NETWORKS: Cellular Network Organization, Operation of Cellular Systems, Hand off, Power Control, First Generation Analog, Second Generation TDMA-GSM, Network Architecture, short Messaging Service in GSM, Second Generation CDMA-IS95, GPRS –Third Generation Systems –WCDMA/CDMA 2000. (9)

WIRELESS LOCAL AREA NETWORKS: Introduction to Wireless LANs – WLAN Equipment, Topologies, Technologies, IEEE 802.11 WLAN – Architecture and Services, Physical Layer- MAC Sub Layer –MAC Management Sub Layer, Other IEEE 802.11 Standards, HIPERLAN, Worldwide Interoperability for Microwave Access (WiMAX). (9)

ADHOC WIRELESS NETWORKS: Characteristics of Adhoc Networks, Classifications of MAC Protocols - Table driven and Source initiated On Demand routing protocols, OLSR, Hierarchical routing protocols – CBRP, FSR, TCP over Ad Hoc Wireless Networks.(8)

WIRELESS PERSONAL AREA NETWORKS: Introduction to Bluetooth , Protocol Stack ,Network Connection Establishment, Topology Applications ,Interference between Bluetooth and 802.11,Low Rate and High Rate WPAN ,Wireless Sensor Network, Protocol Stack, ZigBee Technology IEEE 802.15.4 WPAN Device Architecture –IEEE 802.15.3 – Ultra Wideband. (10)

SATELLITE COMMUNICATION AND GLOBAL POSITIONING SYSTEM : Introduction to satellite communication , Satellite parameters and Configuration-Communication with a satellite ,Different types of Satellite – Design and Principle of operation of GPS ,Satellite Segment , Control Segment ,User Segment -Differential GPS. (9)

REFERENCES
1. William Stallings, "Wireless Communications and Networks", Pearson Education, 2009.
2. Vijay K Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2010.
3. Gary S Rogers & John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2012.
4. Pahlavan K and Krishnamurthy P , "Principles of Wireless Networks - A Unified Approach", Oxford : Wiley-Blackwell, 2013.
5. Siva Ram Murthy C, Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2006.
6. Steve Rackley , "Wireless Networking Technology: From Principles to Successful Implementation", Elsevier Publications, 2007.

15NN33 INTERNET OF THINGS

3 0 0 3

INTRODUCTION: Overview, Flavor of the IOT, The "Internet" of "Things", Technology, Enchanted objects, Making of Internet of Things, Design Principles for Connected Devices (6)

IOT ARCHITECTURE: Background and Initial Visions, Definitions and Functional Requirements, Opportunities and Motivation, Future Developments , Possible Architecture for the future IOT, Fog Computing. (9)

INTERNET PRINCIPLES: Internet Communication, IP addresses, MAC addresses, TCP and UDP Ports, Application Layer Protocols, IEEE 802 committee family of protocols, Physical layer, Media-Access Control Layer. (10)

PROTOTYPING: Prototypes and Production, Open Source versus Closed Source, Prototyping embedded devices- Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Electric Imp. (8)

PROTOTYPE TO REALITY: Business Models- Business Model Canvas, Models, Funding an Internet of Things Startup, Lean Startup, Ethics. (6)

APPLICATIONS: Smart Grid Introduction, Marginal cost of Electricity: Base and Peak production, Managing Demand, Demand Response for Transmission System Operators, Smart home, Smart city, Health care. (6)

REFERENCES:
1. Adrian McEwen and Hakim Cassimally , "Designing the Internet of Things", John Wiley and Sons Ltd, UK, 2014.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, New York, 2011.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", John Wiley and Sons Ltd., UK, 2012.
4. David Boswarthick, Omar Elloumi, Olivier Hersent, "M2M Communications: A Systems Approach", John Wiley and Sons Ltd, UK, 2012.
5. Nik Bessis and Ciprian Dobre, "Big Data and Internet of Things: A Roadmap for Smart Environments", Spring International Publishing, Switzerland, 2014.

15NN34 NETWORK ANALYSIS

3 0 0 3

INTRODUCTION: Network performance issues, Techniques for network performance analysis, Performance measures, Bottlenecks in network traffic, Monitoring network performance, Open source tools. (6)

MAC PROTOCOLS: Error Detection, Flow control, Fast Ethernet, Gigabit Ethernet, Wi-Fi, and Worldwide Interoperability for Microwave Access (WiMAX). (8)

MULTIPLEXING MODELS: Multiplexing of Traffic on a Communication Link, Queueing Models: Little's Theorem, M / M /1 Queueing System, Markov Systems, M/G/1 System, Networks of Queues-Jackson's Theorem. (9)

ROUTING PROTOCOLS: Issues in Routing, Characterization of Optimal Routing, Feasible Direction Methods and projection methods for Optimal Routing. (7)

MODELING NETWORK TRAFFIC: Flow traffic models, Continuous-Time Modeling, Discrete-Time Modeling, Self-Similar Traffic, Traffic Modeling with Arbitrary Source Distribution, Destination Statistics. (8)

SCHEDULING ALGORITHMS: Packet Selection Policy, Packet Dropping Policy, Fair Sharing Policy, Scheduler Design Issues, Scheduler Performance Measures, Fair Queuing (FQ) - Frame-Based and Core-Stateless Fair Queuing. (7)

Total L: 45

REFERENCES:
1. Gebali.F, ,"Analysis of Computer and Communication Networks", Springer US, 2008.
2. Matthew N.O. Sadiku, Sarhan M. Musa, "Performance Analysis of Computer Networks", Springer, 2013.
3. Ulrik Brandes, Thomas Erlebach, "Network Analysis: Methodological Foundations", Springer, 2010.
4. Vijay K Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2010.

15NN35 DISTRIBUTED SYSTEMS

3 0 0 3

INTRODUCTION: Characterization of distributed systems, System models, Architectural models, Fundamental models, Networking and Internetworking, Network principles, Inter-network protocols , Inter process communication, API for the Internet protocols, External data representation and marshalling, Client/server communication, Group communication, RPC communication. (6)

SYSTEM INFRASTRUCTURE FOR DISTRIBUTED SYSTEMS: Operating system support, Security, Distributed file systems, google FS, Distributed Shared Memory: Design and implementation models - Consistency Models. (10)

DISTRIBUTED ALGORITHMS: Clocks, Event and Process states, Clock synchronization, Event ordering, Logical time and logical clocks, Global States, Distributed Mutual Exclusion, Election algorithms, Consensus problems. (9)

DISTRIBUTED TRANSACTIONS: Transactions and concurrency control, Distributed transactions, Flat and nested distributed transactions, Concurrency control, Distributed deadlocks, Replication, Fault tolerance. (10)

DISTRIBUTED OBJECTS TECHNOLOGY: Distributed objects and remote invocation, Directory and discovery services, Case study: sun RPC – DCE RPC – MS RPC – CORBA – JAVA RMI – COM – SOAP – J2EE and Enterprise Computing, SOA and Cloud Computing. (10)

Total L:45

REFERENCES:
1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Pearson Education, New Delhi, 2011.
2. Liu M L, "Distributed Computing Principles and Applications", Pearson Education, New Delhi, 2005.
3. Tanenbaum A S, Van Steen M, "Distributed Systems", Pearson Education, New Delhi, 2006.

15NN36 OPEN SOURCE SYSTEMS

3 0 0 3

INTRODUCTION: Introduction to Open Source, The Philosophy of OSS, Commercial Software and OSS, Free Software and Freeware, Open Source Licenses, Copyrights and Copyleft, Patents. Economics Of FOSS: Zero Marginal Cost, Income, Generation Opportunities, Problems with Traditional Commercial Software, Internationalization. (8)

LINUX OPERATING SYSTEM: Kernel, Compiling the kernel, Architecture, File systems, System calls, Device drivers under Linux. (8)

DATABASES: MySQL, Postgres: Introduction, Database storage engines, Database administration, Basic SQL elements, Working with Tables, Operators and regular expressions, Joins, Views, Functions, Connectivity. (12)

PROGRAMMING LANGUAGES: PHP, Python: Variables and operators, Flow control structures, Functions, Regular expressions, Working with database. (10)

TOOLS AND TECHNOLOGIES: Apache web server, Mozilla Firefox, LaTeX, Eclipse IDE, Orange, Selenium IDE, open source bibliometric software's like pajek, ucinet , Case study: Podcasts, Social Network Engine.   (7)

Total L: 45

REFERENCES:
1. Kailash Vadera and Bhavyesh Gandhi, "Open Source Technology", University Science Press, New Delhi, 2009
2. Christopher Negus and Christine Bresnahan, "Linux Bible", Wiley, USA, 2015.
3. John V. Guttag, Introduction to Computation and Programming Using Python: With Application to understanding Data", MIT Press, England, 2016
4. Julie Meloni, "Teach Yourself PHP, MySQL and Apache All in One", Pearson Education, USA, 2012.
5. Paul Kavanagh, "Open Source Software, Implementation and Management", Elsevier, USA, 2005.

ONE CREDIT COURSES

For the detailed syllabi of the electives and one credit courses offered by other departments refer to the syllabi of M.E- Automotive Engineering offered by Automobile Engineering Department.