KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING
(FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT17	Probability and Statistical Methods	3	1	0	4	40	60	100
14MST11	Multi core Architectures	3	1	0	4	40	60	100
14MST12	Data Structures and Analysis of Algorithms	3	0	0	3	40	60	100
14MST13	Computer Networks and Management	3	0	0	3	40	60	100
14MST14	Mobile and Pervasive Computing	3	0	0	3	40	60	100
14MST15	Web Technology	3	0	0	3	40	60	100
	PRACTICAL							
14MSL11	Data Structures Laboratory	0	0	3	1	100	0	100
14MSL12	Networks Laboratory	0	0	3	1	100	0	100
				Total	**22**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING
(FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT21	Theoretical Foundations of Computer Science	3	1	0	4	40	60	100
14MST21	Database Technology	3	0	0	3	40	60	100
14MST22	Advanced Java Technologies	3	0	0	3	40	60	100
14MST23	Modern Operating Systems	3	1	0	4	40	60	100
	Elective – I (Professional)	3	0	0	3	40	60	100
	Elective – II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14MSL21	Database Laboratory	0	0	3	1	100	0	100
14MSL22	Operating Systems Laboratory	0	0	3	1	100	0	100
				Total	**22**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING
(FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective – III (Professional)	3	0	0	3	40	60	100
	Elective – IV (Professional)	3	0	0	3	40	60	100
	Elective – V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14MSP31	Project Work - Phase I	0	0	12	6	50	50	100
				Total	**15**			

CA - Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
14MSP41	Project Work - Phase II	0	0	24	12	100	100	200
				Total	**12**			

CA - Continuous Assessment, ESE – End Semester Examination

Total Credits: 71

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M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT17	Probability and Statistical Methods	3	1	0	4	40	60	100
14MST11	Multi core Architectures	3	1	0	4	40	60	100
14MST12	Data Structures and Analysis of Algorithms	3	0	0	3	40	60	100
	PRACTICAL							
14MSL11	Data Structures Laboratory	0	0	3	1	100	0	100
				Total	**12**			

CA - Continuous Assessment, ESE – End Semester Examination

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT21	Theoretical Foundations of Computer Science	3	1	0	4	40	60	100
14MST21	Database Technology	3	0	0	3	40	60	100
14MST22	Advanced Java Technologies	3	0	0	3	40	60	100
	PRACTICAL							
14MSL21	Database Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14MST13	Computer Networks and Management	3	0	0	3	40	60	100
14MST14	Mobile and Pervasive Computing	3	0	0	3	40	60	100
14MST15	Web Technology	3	0	0	3	40	60	100
	PRACTICAL							
14MSL12	Networks Laboratory	0	0	3	1	100	0	100
				Total	**10**			

CA - Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14MST23	Modern Operating Systems	3	1	0	4	40	60	100
	Elective – I (Professional)	3	0	0	3	40	60	100
	Elective – II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14MSL22	Operating Systems Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER SCIENCE AND ENGINEERING (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – V

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective – III (Professional)	3	0	0	3	40	60	100
	Elective – IV (Professional)	3	0	0	3	40	60	100
	Elective – V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14MSP31	Project Work - Phase I	0	0	12	6	50	50	100
				Total	**15**			

CA - Continuous Assessment, ESE – End Semester Examination

SEMESTER – VI

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
14MSP41	Project Work - Phase II	0	0	24	12	100	100	200
				Total	**12**			

CA - Continuous Assessment, ESE – End Semester Examination

Total Credits: 71

LIST OF ELECTIVES					
Course Code	**Course Title**	**Hours/Week**			**Credit**
		L	**P**	**T**	
14MSE01	Adhoc and Wireless Sensor Networks	3	0	0	3
14MSE02	Big Data Analytics *	3	0	0	3
14MSE03	Bio-inspired Computing *	3	0	0	3
14MSE04	Business Intelligence	3	0	0	3
14MSE05	Cloud Computing	3	0	0	3
14MSE06	Compiler Design Techniques	3	0	0	3
14MSE07	Data Mining Techniques	3	0	0	3
14MSE08	Data Visualization Techniques	3	0	0	3
14AEE04	Digital Image Processing	3	0	0	3
14MSE09	Embedded Systems and RTOS	3	0	0	3
14CNT22	High Speed Networks	3	0	0	3
14MIE02	Information Retrieval Techniques	3	0	0	3
14MSE10	Information Storage Management	3	0	0	3
14MSE11	Internet of Things	3	0	0	3
14MSE12	Machine Learning Techniques	3	0	0	3
14MSE13	Object Oriented Software Engineering	3	0	0	3
14MSE14	Randomized Algorithms	3	0	0	3
14MSE15	Security Principles and Practices	3	0	0	3
14MSE16	Semantic Web and Knowledge Management	3	0	0	3
14MIE03	Social Network Analysis	3	0	0	3
14MSE17	Soft Computing	3	0	0	3
14MSE18	Virtualization Techniques	3	0	0	3

*- Open Elective

14AMT17 PROBABILITY AND STATISTICAL METHODS

3 1 0 4

UNIT – I **9**

Random variables: Discrete and Continuous random variables – Probability function – Moments – Moment generating functions and their properties – Two dimensional random variables – Joint distributions – Marginal and Conditional distributions.

UNIT – II **9**

Continuous distributions: Exponential distribution – Gamma distribution – Weibull distribution – Normal distribution – Lognormal distribution.

UNIT –III **9**

Estimation Theory: Point Estimation – Properties of estimators – Method of Maximum Likelihood – Method of Moments – Correlation – Regression.

UNIT – IV **9**

Testing of Hypothesis: Sampling Distributions – Large Sample Tests – z tests - Testing the significance of single proportion - difference of proportions - single mean - difference of means – Small Sample Tests – Testing the significance of means (student's t-test) - Testing the significance of Variances (F-test) - Testing the significance of goodness of fit - independent of attributes (χ^2-test).

UNIT – V **9**

Reliability Engineering: Concepts of Reliability – Failure distributions – Reliability of systems – Systems in series – Systems in parallel – Mixed systems in series and parallel – Maintainability – Reliability under preventive maintenance – Repair maintenance – Availability – Availability function of a single component.

Lecture:45, Tutorial:15, TOTAL: 60

REFERENCE BOOKS:

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury Press, 2002.
2. Richard Johnson, Miller & Freund's, "Probability and Statistics for Engineer", Prentice–Hall, Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern "Applied Multivariate Statistical Analysis", Pearson Education, Asia, Fifth Edition, 2002.
4. Gupta S.C. and Kapoor V.K. "Fundamentals of Mathematical Statistics", Sultan and Sons, 2001.
5. Dallas E. Johnson, "Applied Multivariate Methods for Data Analysis", Thomson and Duxbury Press, 1998.

Course Outcomes:

On completion of the course the students will be able to

- apply probability concepts in computer networks
- use a sample to compute point estimate
- develop various tests of significance for attributes and variables
- test the performance of various components of a system

14MST11 MULTI CORE ARCHITECTURES

3 1 0 4

UNIT – I **9**

Fundamentals of Quantitative Design and Analysis: Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design- Classes of Parallelism – ILP, DLP, TLP and RLP – Multi Threading – SMT and CMP Architectures – Limitations of Single Core Processors – The Multi Core era- Case Studies of Multi Core Architectures.

UNIT – II **9**

DLP in Vector, SIMD and GPU Architectures: Vector Architectures – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units- Detecting and Enhancing Loop Level Parallelism – Case Studies.

UNIT – III **9**

TLP and Multiprocessors: Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency – Inter Connection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT – IV **9**

RLP and DLP in Warehouse Scale Architectures: Programming Models and Workloads for Warehouse scale Computers – Architecture for Warehouse scale computing – Physical Infrastructure and Costs – Cloud Computing – Case Studies.

UNIT – V **9**

Architectures for Embedded Systems: Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – Digital Signal Processor – Embedded Multi Processors – Case Studies.

Lecture:45, Tutorial:15, TOTAL: 60

REFERENCE BOOKS:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann, Elsevier, Fifth Edition, 2012.
2. Kai Hwang, “Advanced Computer Architecture”, Tata McGraw-Hill Education, 2003.
3. Richard Y, Kain, “Advanced Computer Architecture: A Systems Design Approach”, Prentice Hall, 2011.
4. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/ Software Approach”, Morgan Kaufmann, Elsevier, 1997.

Course Outcomes:

On completion of the course the students will be able to

- identify the limitations of ILP and the need for multi core architectures
- identify the issues related to multiprocessing
- summarize the salient features of different multi core architectures and how they exploit parallelism
- critically analyze the different types of inter connection networks
- recognize the architecture of GPUs, Warehouse scale computers and embedded processors

14MST12 DATA STRUCTURES AND ANALYSIS OF ALGORITHMS

3 0 0 3

UNIT – I **9**

Data Strucutres: The Role of Algorithms in Computing- Growth of Functions - Analysis of Recursive and Non-recursive Functions – Lists - Heap Sort – Quick Sort – Sorting in Linear Time

UNIT – II **9**

Advanced Data Structures: Binary Search Trees-Red-Black Trees-Augmenting Data Structures - B-Tress – Binomial Heaps - Fibonacci Heaps

UNIT – III **9**

Algorithm Design Techniques: Overview of Basic Design Techniques: Divide and Conquer(Strassen's Matrix Multiplication) – Dynamic Programming(Rod Cutting)-Greedy Algorithms(Huffman Codes) -String Matching: Naïve Algorithm- Rabin Karp Algorithm-String matching with finite automata- Knuth-Morris- Pratt Algorithm- Computational Geometry: Line Segment Properties- Determining segments intersection – Convex Hull – Closest pair of points

UNIT – IV **9**

Graph Algorithms: Elementary Graph Algorithms- Minimum Spanning Trees- Single Source Shortest Paths- All-Pairs Shortest Paths-Maximum Flow

UNIT – V **9**

Other Algorithms: NP-Completeness: Polynomial Time verification, NP Completeness and Reducibility – NP Completeness Proofs – NP Complete Problems- Approximation Algorithms: Traveling Salesman Problem - Sum of Subset Problem - Vertex Cover Problem

TOTAL : 45

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein "Introduction to Algorithms", Third Edition, MIT Press, USA, 2009
2. Levitin, A. "Introduction to The Design and Analysis of Algorithms", Second Edition, Addison Wesley, New York, 2007.
3. Weiss, Mark Allen. "Data Structures and Algorithm Analysis in C++", Third Edition, Pearson Education, New Delhi, 2007.
4. Aho, Alfred V. Hopcroft, John E and Ulllman, Jeffrey D. "Data Structures and Algorithms", Pearson Education, New Delhi, 2002.

Course Outcomes:

On completion of the course the students will be able to

- design and implement elementary data structures
- design and implement advanced data structures
- choose appropriate algorithm design technique and solve problems
- implement graph and other important algorithms

14MST13 COMPUTER NETWORKS AND MANAGEMENT

3 0 0 3

UNIT– I **9**

Introduction to Internet: Internet - Network Edge - Network Core - Access networks - Physical media - NAPs, ISPs and Internet backbones- Delay and loss in packet-switched networks - Protocol layers and their service models. **Application Layer:** Principles of Network applications - World Wide Web and HTTP – FTP - SMTP and MIME – DNS.

UNIT - II **9**

Transport Layer: Services and Principles - Multiplexing and Demultiplexing - Connectionless Transport: UDP - Principles of reliable data transfer - Connection-oriented transport: TCP - Principles of congestion control - TCP congestion control.

UNIT-III **9**

Network Layer: Forwarding and Routing - Network service models - Virtual circuit and Datagram networks - Router architecture - IP forwarding and addressing – IPv4 – IPv6 - ICMP - Routing algorithms: link-state, distance-vector, hierarchical routing in the internet: RIP, OSPF, BGP.

UNIT-IV **9**

Data Link Layer: Introduction and Services **-** Error detection and correction techniques - Multiple access protocols - Link layer addresses, ARP, DHCP. **LAN:** Ethernet - Hubs and switches - IEEE 802.11 LANs: Architecture, MAC Protocol, Frame format, Mobility.

UNIT-V **9**

Network Management: Network Management - Infrastructure network management – internet network management framework - ASN.1 - Firewalls. **SNMPv1:** Organization and Information Models, Communication and Functional Models - SNMPv2 - SNMPv3 - RMON, Network Management Tools.

TOTAL : 45

REFERENCE BOOKS:

1. Kurose, K.F and Ross, K.W, "Computer Networking: A Top - Down Approach Featuring the Internet", Sixth Edition, Pearson Education, New Delhi, 2012.
2. Mani Subramaniam, “Network Management: Principles and Practices”, Pearson Education, Second Edition, 2012.
3. Douglas E. Comer, M.S. Narayanan, “Computer Networks and Internets: with Internet applications”, Pearson Education, Fourth Edition, 2008.
4. William Stallings, “Data and Computer Communication”, Pearson Education, Tenth Edition, 2013

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the layered architecture, functionality of each layers and network models
- compile various protocols used in the internet protocol stack
- outline the principles of wired and wireless LAN technologies
- grasp the fundamentals of and need for network management techniques

14MST14 MOBILE AND PERVASIVE COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Wireless Environment: Introduction to wireless communication-Wireless transmission- Medium Access Control- Wireless MAC protocols -Wireless LANs - WAP-Current trends in wireless network-2G, 3G, looking ahead 4G concepts - Wireless IEEE standards.

UNIT – II **9**

Mobile Communication: GSM - DECT system - TETRA and UMTS - Bluetooth - Wi-Fi – WiMAX - Mobile network layer-Mobile transport layer - Cellular networks - Mobility management - Mobile transaction and commerce-Protocols for mobile commerce - File system support for mobility support - Mobile execution environments and applications.

UNIT – III **9**

Pervasive Communication: Pervasive computing principles - Characteristics of pervasive computing environments -Vision and challenges of pervasive computing - Pervasive computing applications and case study - Pervasive Web Application architecture - Pervasive computing and web based applications- Voice enabling pervasive computing- PDA in pervasive computing- User interface issues in pervasive computing

UNIT – IV **9**

Context Aware Computing: Structure and Elements of Context-aware Pervasive Systems : Abstract architecture – Infrastructures - Middleware and toolkits, Context-aware mobile services : Context for mobile device users – Location-based services- Ambient service- Enhancing Context-aware mobile services and Context aware artifacts

UNIT – V **9**

Context-Aware Pervasive System: Context-aware sensor networks – A framework for Context-aware sensors – Context-aware security systems – Constructing Context-aware pervasive system- Future of Content aware systems

TOTAL : 45

REFERENCE BOOKS:

1. Schiller, Jochen., “Mobile Communications”, Second Edition, PHI/Pearson Education, 2009.
2. Burkhardt Jochen, Henn Horst and Hepper Stefan, Schaec Thomas and Rindtorff Klaus., “Pervasive Computing Technology and Architecture of Mobile Internet Applications”, Addison Wesley Reading, 2007.
3. Seng Loke, “Context-Aware Pervasive Systems: Architectures for a New Breed of Applications”, Auerbach Publications, First Edition, 2006
4. Stallings William, “Wireless Communications and Networks”, Second Edition, PHI/Pearson Education, 2009.
5. Toh, C. K. “Ad Hoc Mobile Wireless Networks: Protocols and Systems,” Prentice Hall, New Delhi, 2002.

Course Outcomes:

On completion of the course the students will be able to

- describe the operation and performance of wireless protocols and provide most recent development in wireless mobile systems
- summarize the concepts and principles of various mobile communication technologies
- demonstrate the working of protocols that support mobility
- illustrate architecture of pervasive computing and identify the applicability of pervasive computing

14MST15 WEB TECHNOLOGY

3 0 0 3

UNIT – I **9**

Introduction to HTML and Javascript: Introduction to HTML5, CSS: Inline Styles, Embedded Style Sheets, Conflicting styles and Linking External Style Sheets, Positioning Elements, Backgrounds, Drop-down Menus, Text Shadows, Rounded Corners, Color, Box Shadows, Gradients, Image Borders, Animation: Selectors, Transitions and Transformations- Downloading web fonts-Flexible Box Layout Module-Multicolumn Layout

UNIT – II **9**

XML: XML Basics, Structuring Data, XML Namespaces, Document Type Definitions- W3C XML Schema Documents-XPATH-XML Vocabularies-Extensible Style Sheet Language and XSL Transformations, XML parsers : DOM, SAX

UNIT – III **9**

Client-Side Technologies: Javascript :Arrays-Objects- Document Object Model(DOM):Objects and Collections- Javascript Event handling -Ajax-Enabled Rich Internet Applications with XML and JSON: Introduction-RIAs with Ajax-Ajax Example using XMLHttpRequest Object-Using XML and the DOM-Creating a Full-Scale Ajax-Enabled Application

UNIT – IV **9**

Server-Side Technologies: Web Application Development with ASP .NET in C#: Multitier Application Architecture, Standard Web Controls, Validation Controls, Session Tracking-Case Study

UNIT – V **9**

Web Services: WCF Services Basics, SOAP, REST, JSON, Publishing and Consuming: SOAP-Based WCF web services, REST-Based XML Web Services, REST-Based JSON Web Services- Using Session Tracking in a SOAP based WCF Web Service- Database Access and Invoking a service from ASP .NET - Equation Generator

TOTAL : 45

REFERENCE BOOKS:

1. James L. Weaver, Kevin Mukhar, James P. Crume and Ivor Horton,"Beginning J2EE 1.4: From Novice to Professional", A Press Beginner Series, 2004
2. William Crawford, Jim Farley, "Java Enterprise in a Nutshell", Third Edition, O'Reilly, ISBN: 0-596-10142-2, 2005
3. John Hunt, **"**Guide to J2EE – Enterprise Java**",** Springer Professional Computing, Vol8(3)2004
4. "Java 6 and J2EE 1.5 – Black Book", Dream Tech Press, Kogent Learning Solutions Inc.
5. Deitel H.M. and Deitel P.J., "Internet and World Wide Web: How to Program", Fifth Edition, Pearson Education Asia, New Delhi, 2011

Course Outcomes:

On completion of the course the students will be able to

- understand the basic concepts of web and scripting languages
- acquire skills to develop client side programs and server side programs
- understand the fundamentals of middleware concepts and SOA in web applications

14MSL11 DATA STRUCTURES LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES:

1. Implement Heap Sort and Quick Sort.
2. Implement Binary Search Trees
3. Implement Red-Black trees
4. Implement Binomial Heap and Fibonacci heaps.
5. Implement Strassen's matrix multiplication algorithm using divide and conquer technique
6. Implement Greedy algorithm for Huffman code
7. Implement String Matching algorithms
8. Implement Graph algorithms.
9. Implement algorithm for Traveling Salesman Problem.
10. Implement algorithm for sum of Subset Problem.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

- Windows-Operating System
- Java, C++

Course Outcomes:

On completion of the course the students will be able to

- design and implement elementary data structures
- design and implement advanced data structures
- choose appropriate algorithm design technique and solve problems
- implement Graph and other important algorithms

14MSL12 NETWORKS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES

1. Switches configuration – Managed and Unmanaged switches.
2. Establishing a Local Area Network (LAN).
3. VLAN Creation, adding resources and configuration.
4. DHCP Server Configuration.
5. Connecting two LANs using multi-router topology with static routes.
6. Defining access control lists and integrating centralized authentication server.
7. Firewall configuration.
8. Installing and configuring open source based packet analyzer and network management tools.

TOTAL : 45

REQUIREMENTS HARDWARE / SOFTWARE:

- Hardware Components: Switches, Routers, Computers
- OS: Linux/Windows
- Packet Analyzer and Network Management Tools

Course Outcomes:

On completion of the course the students will be able to

- configure switches, routers and firewalls
- create LAN, VLAN and Multi-router topology
- analyze the data traffic inside and outside of a router using a network management tool

14AMT21 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE

3 1 0 4

UNIT – I **9**

Fuzzy Logic: Concept of fuzzy sets – Operations on fuzzy sets – Properties of fuzzy set – Fuzzy relations – Features of membership function – Fuzzification – Lambda-cuts for fuzzy sets – Defuzzification to crisp sets.

UNIT – II **9**

Combinatorics: Permutations and Combinations – Pigeonhole principle – Principle of inclusion and exclusion – Mathematical Induction – Recurrence relations – Generating functions.

UNIT – III **9**

Number Theory: Divisibility – Prime numbers – Fundamental theorem of arithmetic – Fermat's Little theorem – GCD – Euclid's algorithm – Congruence – Solution of congruences – Chinese remainder theorem.

UNIT – IV **9**

Algebraic Structures: Groups and subgroups (Definition and examples only) – Homomorphism – Cosets – Lagrange's Theorem – Normal subgroups – Rings – Finite fields – Coding Theory.

UNIT – V **9**

Automata Theory: Formal languages – Phrase structure grammar – Finite state machine – Finite state automata – Pushdown automaton – Turing machine

Lecture:45, Tutorial:15, TOTAL: 60

REFERENCE BOOKS::

1. Timothy J.Ross, "Fuzzy Logic with Engineering applications", McGraw Hill Inc, 2011.
2. Tremblay J.P, Manohar. R, "Discrete Mathematical structures with applications to computer science" Tata Mc-Graw Hill, 2011.
3. Kenneth H. Rosen. "Discrete mathematics and its applications", Tata McGraw Hill, 2010.
4. Alan Doerr and Kenneth Levasseur, "Applied Discrete Structures for Computer Science" Galgotia Publisher, 2011.
5. Alan Tucker, "Applied Combinatorics", John Wiley and Sons, Sixth Edition, 2012.
6. Victor Shoup, "A Computational Introduction to Number Theory and Algebra", Cambridge University Press, Second Edition, 2011.
7. Ivan Niven, Herbert S. Zuckerman and H. L. Montgomery, "An Introduction to the Theory of Numbers", John Wiley, Fifth Edition, 2008.
8. J. E. Hopcroft, Rajeev Motwani, and J. D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Third Edition, Pearson, 2008.

Course Outcomes:

On completion of the course the students will be able to

- design systems using fuzzy logic
- handle network security related problems using number theory concepts
- apply group structures in coding
- model different kinds of machines using finite state machines

14MST21 DATABASE TECHNOLOGY

3 0 0 3

Pre-requisites: Database Management Systems

UNIT – I **9**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

UNIT – II **9**

Concepts for Object Databases: Object Identity – Object Structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle.

UNIT – III **9**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) – Taxonomy – Applications - Design Principles for Active Rules - **Temporal Databases:** Overview of Temporal Databases - TSQL2- **Deductive Databases**: Logic of Query Languages – Datalog - Recursive Rules - Syntax and Semantics of Datalog Languages - Implementation of Rules and Recursion - Recursive Queries in SQL

UNIT – IV **9**

Spatial Databases: Spatial Data Types - Spatial Relationships - Spatial Data Structures - Spatial Access Methods - Spatial DB Implementation - **Mobile Databases:** Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols - Multimedia Databases

UNIT – V **9**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases - XML and SQL - Native XML Databases - Web Databases - Geographic Information Systems - Biological Data Management - **Cloud Based Databases:** Data Storage Systems on the Cloud - Cloud Storage Architectures -Cloud Data Models - Query Languages- Introduction to Big Data-Storage-Analysis.

TOTAL : 45

REFERENCE BOOKS:

1. Elmasri R. and Navathe S.B., “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, Addison Wesley, Sixth Edition, 2010.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Sixth Edition, Pearson Education, 2014
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2011.
4. C.J.Date, A.Kannan and S.Swamynathan, ”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

5. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition, 2004.
6. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, “Advanced Database Systems”, Morgan Kaufmann Publishers, 2006
7. Vijay Kumar, “Mobile Database Systems”, John Wiley and Sons, 2006.

Course Outcomes:

On completion of the course the students will be able to

- choose the appropriate database like parallel, distributed and object oriented for the real time applications
- design a model for store and access intelligent and advanced data bases
- represent the data in XML and handle big data in cloud environment

14MST22 ADVANCED JAVA TECHNOLOGIES

3 0 0 3

Pre-requisites: Object Oriented Programming Concepts and Core Java

UNIT – I **9**

Java I/O and Networking: Introduction-File-Stream Classes - Byte and Character Streams - using Stream I/O – Serialization -Stream Benefits - Networking Basics - Java and the Net – Inetaddress - TCP/IP Client and Server Sockets – URL – URLConnection – HttpURLConnection – Datagrams - Inet4Address and Inet6Address - URI Class - Cookies – RMI/IIOP.

UNIT – II **9**

Servlets And JSP: Servlet basics - Life cycle - Retrieving and Sending Information - Session Tracking - Database Connectivity - JDBC API - Servlet Collaboration - Enterprise Servlets. JSP Overview- Model View Control (MVC) Architecture - Generating Dynamic Content - Scripting Elements - Custom and Standard Tags - I/O Processing - Sharing data between JSP Pages - Accessing a database -Internationalization.

UNIT – III **9**

Struts and Java Server Faces: Enabling Struts Development - Configuring Struts Applications - User Interface - Form Processing -Leveraging Actions - Input Validation - Connecting to the data. JSF – Introduction - Simple application - Life cycle - Managed Beans and Expressions - Navigation and UI model - Validating data – Event Model.

UNIT – IV **9**

EJB: Introduction to EJB – Architecture - Service providers - Container providers - Session, Entity and Message driven Beans – EJB deployment.

UNIT – V **9**

Hibernate and Spring: Hibernate3.5 - Integrating and Configuring Hibernate - Simple Application - Persistence Life cycle –mapping – Annotations - Creating mappings with Hibernate files - using the Session - Searches and Queries- Spring Architecture – Simple example.

TOTAL : 45

REFERENCE BOOKS:

1. Schildt Herbert, “Java 2: The Complete Reference”, Ninth Edition, Tata McGraw Hill, 2014.
2. Jason Hunter and William Crawford, ”Java Servlet Programming”, O’Reilly Publishers, Second Edition, 2001.
3. Hans Bergsten, “Java Server Pages”, O’Reilly Publishers, Third Edition, 2004.
4. Bill Siggelkow, “Jakarta Struts Cookbook”, O’Reilly Publishers, First Edition, 2005.
5. Chris Schalk and Ed Burns,”JavaServer Faces 2.0: The Complete Reference”, Second Edition, Tata McGraw Hill, 2010.
6. Asbury Stephen and Weiner Scott R., “Developing Java Enterprise Applications”, Second Edition, Wiley Publications, 2001.
7. Jeff Linwood and Dave Minter, “Beginning Hibernate”, Second Edition, APress Publishers, 2010.

Course Outcomes:

On completion of the course the students will be able to

- express the java streams, socket programming and serialization concepts
- outline the architectural design and applications of Java Servlets, JSP, struts and JSF
- illustrate the significance of EJB, Spring and Hibernate frameworks in building enterprise applications
- demonstrate critical thinking in the understanding, evaluation and application of java technology solutions to real-life situations

14MST23 MODERN OPERATING SYSTEMS

3 1 0 4

UNIT – I **9**

Fundamentals of Operating Systems: Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques

UNIT – II **9**

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT – III **9**

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non-blocking Commit Protocol – Security and Protection.

UNIT – IV **9**

Multiprocessor and Database Operating Systems: Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling –Memory Management – Reliability / Fault Tolerance; Database Operating Systems: Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control Algorithms.

UNIT – V **9**

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management - File system.

Lecture:45, Tutorial:15, TOTAL: 60

REFERENCE BOOKS:

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley and Sons, 2004.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
4. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", Third Edition, O'Reilly, 2005
5. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
6. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload Media, 2011.

Course Outcomes:

On completion of the course the students will be able to

- deliberate the various synchronization and scheduling issues
- demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of distributed operating system
- discuss the various distributed systems and database operating system concepts
- identify the different features of real time and mobile operating systems

14MSL21 DATABASE LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES:

1. Implement insert, modify, delete and search operations in a relational database using B+ tree structure

2. Create a distributed database and run various queries using stored procedures.

3. Execute the queries using object oriented database.

4. Access parallel databases from a programming language such as Java/Python.

5. Create an Active Database including Triggers and assertions.

6. Create a knowledge database with facts and extract data using rules.

7. Create an XML Schema for a company database.

8. Work with Weka tool for classification and clustering techniques.

9. Case Study

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

- Windows – Operating System
- Oracle
- Java
- Weka
- Prolog

Course Outcomes:

On completion of the course the students will be able to

- design and work with distributed database, parallel database and object database
- represent and work with active database, deductive database and XML
- classify and cluster the data using weka tool

14MSL22 OPERATING SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES:

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write programs to simulate UNIX commands like ls, grep, etc.
4. Write programs to implement various scheduling policies.
5. Develop Application using Inter Process communication (using shared memory, pipes or message queues.
6. Implement the Producer – Consumer problem using semaphores (using UNIX system calls)
7. Implement memory management schemes.
8. Implement distributed mutual exclusion algorithms
9. Implement centralized and distributed deadlock detection Algorithms.
10. Implement concurrency control algorithms.
11. Implement simple mobile applications (Antroid)

TOTAL : 45

REFERENCES / MANUALS/SOFTWARE:

- Linux-Operating System, Android
- C / C++ /Java

Course Outcomes:

On completion of the course the students will be able to

- implement and demonstrate the fundamentals of Operating Systems
- implement the concepts of distributed operating system
- implement database operating system concepts
- implement mobile applications

14MSE01 ADHOC AND WIRELESS SENSOR NETWORKS

(Common to Computer Science and Engineering & Information Technology)

3 0 0 3

Pre-requisites: Computer Networks

UNIT – I **9**

Wireless Network: Characteristics of wireless channel - Fundamentals of WLANs - IEEE 802.11 Standard - HIPERLAN Standard–Bluetooth-Cellular Concept and Architecture – WLL - Wireless ATM - IEEE 802.16 Standard - HIPERACCESS – Ad hoc Wireless Network - Recent Advances in Wireless Network.

UNIT – II **9**

MAC Protocols: MAC Protocols design issues - Goals and Classification - Contention based Protocols –MACAW –Contention based reservation scheme-D-PRMA-Contention based with scheduling mechanisms-DPS

UNIT – III **9**

Routing Protocols: Design issues and Classification - Table-driven(DSDV), On-demand(DSR)-Hybrid routing protocols(ZRP) - Routing protocols with efficient flooding mechanisms(PLBRP) – Hierarchical(HSRP) and power-aware routing protocols(PARM). Multicast routing protocols design issues and operation - Architecture reference model – Classification.

UNIT – IV **9**

Introduction to WSN: Overview of Wireless Sensor Networks-Architecture-Constraints and Challenges-Advantages and Applications - Data Dissemination and Gathering-MAC – Localization and Tracking

UNIT – V **9**

WSN Routing and QoS: Geographic Routing- Attribute Routing – Infrastructure Establishment-Sensor Tasking and Control - Quality of Sensor Network-Evolving Standards-Other Issues

TOTAL : 45

REFERENCE BOOKS:

1. Siva Ram Murthy, C. and Manoj, B.S., "AdHoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR, 2007.
2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks - an information processing approach", Morgan Kaufman Publishers, 2004.
3. Toh C.-K., "AdHoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall PTR, 2001.
4. Mohammad Ilyas, "The Handbook of AdHoc Wireless Networks", CRC press, 2002.
5. Ramin Hekmat, "Ad-hoc Networks: Fundamental Properties and Network Topologies", Springer, First Edition, 2006.

Course Outcomes:

On completion of the course the students will be able to

- express the basic wireless network concepts
- relate the MAC and routing protocols of ad hoc networks
- outline the application of WSN and usage of higher layers of adhoc networks

14MSE02 BIG DATA ANALYTICS

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Big Data: Analytics – Nuances of Big Data – Value – Issues – Case for Big Data – Big Data options Team challenge – Big Data sources – Acquisition – Nuts and Bolts of Big Data - Features of Big Data - Security, Compliance, Auditing and Protection - Evolution of Big Data – Best Practices for Big Data Analytics - Big Data Characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration Tools – Greenplum – Informatica.

UNIT – II **9**

Data Analysis: Evolution of Analytic Scalability – Convergence – Parallel Processing Systems – Cloud Computing – Grid Computing – Map Reduce – Enterprise Analytic Sand Box – Analytic Data sets – Analytic Methods – Analytic Tools – Cognos – Microstrategy – Pentaho - Analysis Approaches – Statistical Significance – Business Approaches – Analytic Innovation – Traditional Approaches – Iterative.

UNIT – III **9**

Stream Computing: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting distinct elements in a Stream – Estimating Moments – Counting oneness in a Window – Decaying Window - Realtime Analytics Platform(RTAP) Applications - IBM Infosphere – Big Data at rest – Infosphere Streams – Data Stage – Statistical Analysis – Intelligent Scheduler – Infosphere Streams.

UNIT- IV **9**

Predictive Analytics and Visualization: Predictive Analytics – Supervised – Unsupervised Learning – Neural Networks – Kohonen Models – Normal – Deviations from Normal Patterns – Normal behaviours – Expert options – Variable entry - Mining Frequent Itemsets - Market based model – Apriori Algorithm – Handling large data sets in main memory – Limited Pass algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K Means Clustering- High Dimensional Data Visualizations - Visual data Analysis Techniques - Interaction Techniques: Systems and Applications.

UNIT- V FRAMEWORKS AND APPLICATIONS **9**

IBM for Big Data – Map Reduce Framework - Hadoop – Hive – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Hbase – Impala – Analyzing Big Data with Twitter – Big Data for Ecommerce – Big Data for Blogs.

TOTAL : 45

REFERENCE BOOKS:

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, 2007.
4. Michael Berthold, David J. Hand, ” Intelligent Data Analysis”, Springer, 2007.

5. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

Course Outcomes:

On completion of the course the students will be able to

- describe the concepts and characteristics of Big Data
- recognize the usage of data analytics and its related tools
- discuss the concept of stream computing and real time applications
- categorize the predictive analysis techniques and determine the use of Hadoop frameworks

14MSE03 BIO INSPIRED COMPUTING

3 0 0 3

UNIT – I **9**

Introduction: What is Life? - Life and Information - The Logical Mechanisms of Life - What is Computation? Universal Computation and Computability - Computational Beauty of Nature (fractals, L-systems, Chaos) - Bio-inspired computing – Natural computing -Biology through the lens of computer science

UNIT – II **9**

Complex Systems and Artificial Life: Complex Systems and Artificial Life - Complex Networks - Self-Organization and Emergent Complex Behavior - Cellular Automata - Boolean Networks -Development and Morphogenesis - Open-ended evolution

UNIT – III **9**

Natural Computation and Neural Networks: Biological Neural Networks- Artificial Neural Nets and Learning – Pattern Classification and Linear Separability - Single and Multilayer Perceptrons – Back-Propagation - Associative Memory - Hebbian Learning - Hopfield Networks - Stochastic Networks – Unsupervised Learning

UNIT – IV **9**

Evolutionary Systems and Algorithms: Evolutionary Programming: Biological Adaptation and Evolution – Autonomous Agents and Self-Organization: Termites, Ants, Nest building, Flocks, Herds and Schools. Genetic Algorithms: Schema Theorem – e-production-Crossover-Mutation Operators

UNIT – V **9**

Competition, Cooperation and Swarm Intelligence: Collective Behavior and Swarm Intelligence - Social Insects - Stigmergy and Swarm Intelligence- Competition and Cooperation - Zero- and Nonzero-sum games - Iterated prisoner's dilemma - Stable strategies - Ecological and Spatial Models - Communication and Multi-Agent Simulation – Immuno Computing

TOTAL : 45

REFERENCE BOOKS:

1. Leandro Nunes De Castro, Fernando Jose Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Publishing, 2005.
2. Leandro Nunes De Castro , "Fundamentals of Natural Computing: Basic concepts, Algorithms and Applications", Chapman and Hall, CRC Computer and Information Science Series, 2006.
3. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies", MIT Press, 2008.
4. http://informatics.indiana.edu/rocha/i-bic/
5. http://web.eecs.utk.edu/~mclennan/Classes/420/

Course Outcomes:

On completion of the course the students will be able to

- explain how biological systems exploit natural processes
- visualize how complex and functional high-level phenomena can emerge from low-level interactions
- understand how large numbers of agents can self-organize and adapt
- design and implement simple bio-inspired algorithms

14MSE04 BUSINESS INTELLIGENCE

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Business Intelligence: Introduction to Digital Data and its Types – Structured, Semi-structured and Unstructured Data - Introduction to OLTP and OLAP – Architectures – Data Models – Role of OLAP in BI – OLAP Operations – Business Intelligence - BI Definition and Evolution – BI Concepts - BI Component Framework – BI Process, Users, Applications – BI Roles – BI Best Practices – Popular BI Tools.

UNIT – II **9**

Data Integration: Need for Data Warehouse – Definition of Data Warehouse – Data Mart – Ralph Kimball's Approach vs. W.H.Inmon's Approach – Goals of Data Warehouse – ETL Process – Data Integration Technologies – Data Quality – Data Profiling – Case Study from Healthcare domain – Kettle Software: Introduction to ETL using Pentaho Data Integration

UNIT – III **9**

Multidimensional Data Modeling: Basics of Data Modeling – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension Table – Dimensional Models - Dimensional Modeling Life Cycle – Designing the Dimensional Model - Measures, Metrics, KPIs and Performance Management – Understanding Measures and Performance – Measurement System - Role of metrics – KPIS - Analyze Data using MS Excel 2010

UNIT – IV **9**

Basics of Enterprise Reporting: Reporting Perspectives - Report Standardization and Presentation Practices– Enterprise Reporting Characteristics - Balanced Scorecard - Dashboards - Creating Dashboards - Scorecards vs. Dashboards - Analysis - Enterprise Reporting using MS Access / MS Excel

UNIT – V **9**

BI Applications and Case Studies: Understanding Business Intelligence and Mobility – Business Intelligence and Cloud Computing – Business Intelligence for ERP Systems – Social CRM and Business Intelligence - Case Studies : Good Life HealthCare Group, Good Food Restaurants Inc., TenToTen Retail Stores

TOTAL: 45

REFERENCE BOOKS:

1. N.Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley-India Publication, 2011 Edition, Reprint 2012.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence: A Managerial Approach", Second Edition, Pearson Education, 2011.
3. David Loshin, "Business Intelligence", Morgan Kaufmann Publishers, San Francisco, Fifth Edition, 2007
4. Mike Biere, "Business Intelligence for the Enterprise", Pearson Education, Tenth Edition, 2008
5. Larissa Terpeluk Moss, Shaku Atre, "Business Intelligence Roadmap", Pearson Education, 2007

Course Outcomes:

On the completion of the course the students will be able to

- describe about key elements of Data Warehouse and Business Intelligence
- explain about analysis, integration and reporting services
- identify the functionalities of Key Performance Indicators

14MSE05 CLOUD COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction: Overview – Cloud Components – Infrastructure – Services- Applications – Benefits – Limitations – Security Concerns – Regularity Issues. Hardware and Infrastructure – Clients –Security –Network –Services – Accessing the Cloud – Platforms, Applications.

UNIT – II **9**

Cloud delivery model: Software as a Service - Service providers – Services and Benefits. Platform as a Service - Service providers – Services and Benefits. Infrastructure as a Service - Service providers- Services and Benefits. Cloud deployment model : Public clouds – Private clouds – Community clouds - Hybrid clouds – Commoditization in cloud computing and Advantages of Cloud computing

UNIT – III **9**

Virtualization: Virtualization and cloud computing – Virtualization benefits- Server virtualization – VM, Hardware virtualization – OS virtualization - Storage virtualization –Network attached storage - Cloud Server virtualization – Networking essential to cloud. Microsoft Implementation: Microsoft Hyper V- VMware features and infrastructure – Virtual Box - Thin client.

UNIT – IV **9**

Using Cloud Services: Collaborating on Calendars, Schedules and Task Management - Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management –Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files. Collaborating via Web-based communication tools

UNIT – V **9**

Cloud Security and Case Study: Federation in Cloud – Presence in cloud – Privacy and its relation to Cloud based information systems. Security in Cloud. Case Study: OpenStack

TOTAL : 45

REFERENCE BOOKS:

1. Anthony T.Velte , Toby J. Velte Robert Elsenpeter, “Cloud Computing - A practical approach”, Tata McGraw- Hill , New Delhi, 2010.
2. Rittinghouse John W, Ransome James F, “Cloud Computing-Implementation, Management and Security”, CRC Press, Taylor and Francis Group, 2012.
3. Michael Miller, Cloud Computing, “Web-Based Applications that Change the Way You Work and Collaborate Online”, Que Publishing, 2008.
4. Kumar Saurabh, “Cloud Computing”, Wiley India Pvt. Ltd, Second Edition, 2012.

Course Outcomes:

On the completion of the course the students will be able to

- explore online applications of cloud services
- implement cloud computing for the corporation
- design various applications by integrating cloud services

14MSE06 COMPILER DESIGN TECHNIQUES

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction: Language Processors - The Structure of a Compiler – The Evolution of Programming Languages-– Applications of Compiler Technology Programming Language Basics - The Lexical Analyzer Generator -Parser Generator -Intermediate Code Generation techniques - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

UNIT – II **9**

Instruction Parallelism: Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Software Pipelining.

UNIT - III **9**

Optimizing for Parallelism and Locality: Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.

UNIT - IV **9**

Optimizing for Parallelism and Locality – Application: Finding Synchronization - Free Parallelism – Synchronization between Parallel Loops – Pipelining– Locality Optimizations – Other Uses of Affine Transforms.

UNIT – V **9**

Interprocedural Analysis: Basic Concepts – Need for Inter procedural Analysis – A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm – Context Insensitive Inter procedural Analysis - Context-Sensitive Pointer-Analysis – Data log Implementation by Binary Decision Diagrams.

TOTAL: 45

REFERENCE BOOKS:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2008.
2. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers, 2002.
3. Steven S. Muchnick, “Advanced Compiler Design and Implementation”, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003

Course Outcomes:

On the completion of the course the students will be able to

- design and implement scanner and parser by using its own pattern
- use the knowledge of patterns, tokens and regular expressions for solving a problem in the field of data mining
- apply the new code optimization techniques to improve the performance of a program in terms of speed and space
- explore the architectural design of the system
- evaluate the knowledge needed for modern compiler and its features

14MSE07 DATA MINING TECHNIQUES

3 0 0 3

UNIT – I **9**

Introduction: Data Mining-Steps in Knowledge Discovery Process- Kinds of Data and Patterns – Technologies used-Targeted applications - Major issues in Data Mining - Data objects and attribute types - Statistical descriptions of data - Data Visualization- Measuring data similarity and dissimilarity

UNIT – II **9**

Data Preprocessing: Data Cleaning, Integration, Reduction, Transformation and Discretization, Mining Frequent Patterns - Frequent Itemset Mining Methods- Pattern Evaluation Methods-Mining in Multilevel and Multidimensional Space - Constraint based Frequent Pattern Mining

UNIT- III **9**

Classification: Decision Tree Induction-Bayesian Classification-Rule based classification-Classification by Back Propagation – Support Vector Machines – Lazy Learners –Model Evaluation and Selection- Techniques to improve Classification Accuracy - k-Nearest Neighbor Classifier

UNIT- IV **9**

Clusters Analysis: Partitioning Methods – Hierarchical Methods – Density based Methods - Grid based Methods - Evaluation of Clustering – Outliers and Outlier analysis - Outlier detection Methods - Statistical Approaches

UNIT- V **9**

Applications: Mining Complex data types - Statistical Data Mining - Data Mining foundations - Visual and Audio Data Mining – Applications - Ubiquitous and invisible Data Mining - Social impacts of Data Mining.

TOTAL : 45

REFERENCE BOOKS:

1. Han Jiawei, and Kamber Micheline, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers, 2012.
2. Berson Alex, and Smith Stephen J., “Data Warehousing, Data Mining and OLAP”, Tata Mcgraw- Hill, New Delhi, 2004.
3. Gupta G.K., “Introduction to Data Mining with Case Studies”, Prentice Hall India, New Delhi, 2006.
4. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Third Edition, Morgan Kaufmann, 2011

Course Outcomes:

On completion of the course the students will be able to

- describe the different data mining and preprocessing techniques
- categorize the association rule mining and classification methods
- summarize different clustering and outlier methods used in data mining
- apply the concepts of data mining in real world problems

14MSE08 DATA VISUALIZATION TECHNIQUES

3 0 0 3

Pre-requisites: Database Management Systems and Data Mining Concepts

UNIT – I **9**

Core Skills for Visual Analysis: Information visualization – Effective data analysis – Traits of meaningful data – Visual perception –Making abstract data visible – Building blocks of information visualization – Analytical interaction –Analytical navigation – Optimal quantitative scales – Reference lines and regions – Trellises and crosstabs – Multiple concurrent views – Focus and context – Details on demand – Over-plotting reduction – Analytical patterns – Pattern examples.

UNIT – II **9**

Time-Series, Ranking, and Deviation Analysis: Time-series analysis –Time-series patterns – Time-series displays – Time-series best practices –Part-to-whole and ranking patterns – Part-to-whole and ranking displays – Best practices – Deviation analysis – Deviation analysis displays – Deviation analysis best practices

UNIT – III **9**

Distribution, Correlation and Multivariate Analysis: Distribution analysis – Describing distributions – Distribution patterns – Distribution displays – Distribution analysis best practices – Correlation analysis – Describing correlations – Correlation patterns – Correlation displays – Correlation analysis techniques and best practices – Multivariate analysis – Multivariate patterns – Multivariate displays – Multivariate analysis techniques and best practices.

UNIT – IV **9**

Information Dashboard Design I: Information dashboard – Categorizing dashboards – Typical dashboard data – Dashboard design issues and best practices – Visual perception – Limits of short-term memory – Visually encoding data – Gestalt principles – Principles of visual perception for dashboard design.

UNIT – V **9**

Information Dashboard Design II: Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard, CIO dashboard, Telesales dashboard, Marketing analysis dashboard.

TOTAL : 45

REFERENCE BOOKS:

1 Stephen Few, "Now you see it: Simple Visualization Techniques for Quantitative Analysis", Analytics Press, 2009.
2 Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", O'Reilly, 2006.
3 Edward R. Tufte, "The Visual Display of Quantitative Information", Second Edition, Graphics Press, 2001.
4 Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
5 Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

6 Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
7 Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley 2011.

Course Outcomes:

On completion of the course the students will be able to

- describe principles of visual perception
- apply core skills for visual analysis
- apply visualization techniques for various data analysis tasks
- design information dashboard

14AEE04 DIGITAL IMAGE PROCESSING

(Common to Applied Electronics & Computer Science and Engineering)

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Introduction: Elements of Digital Image processing-Elements of visual perception: light – luminance – brightness, contrast, hue, saturation, mach band effect– simultaneous contrast. Two dimensional sampling theory. **2D Image Transforms:** DFT, DCT, Hadamard, Haar, Walsh, KL and SVD.

UNIT – II **9**

Classification of Image Processing operations: Arithmetic operations – Logical operations-Geometrical operations – Interpolation techniques

Image Enhancement: Image quality and need for enhancement – Image enhancement point operations: Linear and non-linear functions – piecewise linear functions – Histogram based techniques. Spatial Filtering: Image smoothing spatial filters – Image sharpening spatial filters.

UNIT – III **9**

Image Restoration: Image restoration model – Noise modeling- Image restoration in the presence of noise only: Mean filters – Order-statistics filters. Image restoration techniques: Constrained method – Unconstrained method: Wiener filter – Inverse Filter

Image Segmentation: Edge detection – Types of edge detectors - Segmentation based on thresholding-Region based: Region growing-Region splitting and merging.

UNIT – IV **9**

Image Morphology: Need for morphological processing – Morphological operators – Hit or Miss Transform –Basic morphological algorithms : Boundary extraction – Noise removal – Thinning – Thickening – Skeletonization

Image Compression: Need for Compression- Run length encoding-Huffman coding-Arithmetic coding – Predictive Coding -Transform based compression-Vector quantization- Block truncation coding- Wavelet based image compression

UNIT – V **9**

Image Representation: Representation: chain codes – polynomial approximations – signatures – boundary descriptors – Regional descriptors: Texture regional descriptor.

Colour Image Processing: Light and color- Colour formation: Additive and subtractive, colour models-RGB, HIS and its conversions-Histogram equalization- Colour image segmentation.

TOTAL : 45

REFERENCE BOOKS:

1. Gonzalez, Rafel C. and Woods, Richard E., “Digital Image Processing”, Second Edition, Prentice Hall, New York, 2006.
2. Jain, Anil K., “Fundamentals of Digital Image Processing”, Prentice Hall of India, New Delhi, 2003
3. S.Sridhar, “ Digital Image Processing “, Oxford University Press, Newdelhi,2011.
4. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, “Digital Image Processing” Tata McGraw-Hill, New Delhi 1st ed 2009 .

Course Outcomes:

On completion of the course the students will be able to

- understand digital image processing fundamentals, sampling and quantization concepts for 2D images
- apply image processing techniques in both the spatial and frequency domains using various transform techniques
- develop simple algorithms for smoothening, sharpening and segmentation of 2D images
- use various image processing techniques for real time applications

14MSE09 EMBEDDED SYSTEMS AND RTOS

3 0 0 3

UNIT – I **9**

Introduction to Embedded Systems: Processor Embedded into a System - Embedded Hardware Units, Devices and Software in a System – Examples of Embedded Systems – Embedded System-on-chip (Soc) and Use of VLSI Circuit Design Technology. **Devices and Communication Buses for Devices Network:** I/O Types and Examples –Serial Communication Devices - UART and HDLC - Parallel Device Ports - Sophisticated interfacing features in Device Ports- Timer and Counting Devices - Serial Bus Communication Protocols, Parallel Bus Device Protocols—Parallel Communication Network Using ISA, PCI, PCI-X and Advanced Buses - Internet Enabled Systems—Network Protocols – Wireless and Mobile System Protocols.

UNIT – II **9**

Programming Concepts: Software Programming in Assembly Language (ALP) and in High-Level Language 'C' - C Program Elements: Header and Source Files and Preprocessor Directives - Macros and Functions - Data Types, Data Structures, Modifiers, Statements, Loops and Pointers - Object-Oriented Programming - Embedded Programming in C++ - C Program compilers – Cross compiler – Optimization of memory codes.

UNIT – III **9**

Inter Process Communication and Synchronization: Multiple Processes in an Application - Multiple Threads in an Application – Tasks - Task States - Task and Data - Distinction between Functions, ISRS and Tasks by their Characteristics - Concept of Semaphores - Shared Data - Interprocess Communication - Signal Function - Semaphore Functions - Message - Queue Functions - Mailbox Functions - Pipe Functions -Socket Functions - RPC Functions.

UNIT - IV **9**

Real Time Operating Systems: OS Services- Process Management – Memory Management – Timer Functions - Event Functions - Memory Management - Device, File and IO Subsystems Management - Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls - Real-time Operating Systems - Basic Design using an RTOS - RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics - OS Security Issues.

UNIT- V **9**

Study of MICROC/OS-II: RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS – Understanding Case Definition – Multiple Tasks and their functions – Creating a list of tasks –IPC functions – Exemplary Coding Steps.

TOTAL : 45

REFERENCE BOOKS:

1. Raj Kamal. "Embedded Systems: Architecture, Programming and Design", Second Edition, Tata McGraw Hill Education, 2009
2. Heath Steve, "Embedded Systems Design", Second Edition, Newnes, 2003
3. Simon, David E., "An Embedded Software Primer", Pearson Education Asia, 2000.

4. Wolf, Wayne, "Computers as Components; Principles of Embedded Computing System Design", Harcourt India, Morgan Kaufman Publishers, 2001.
5. Vahid Frank and Givargis Tony, "Embedded Systems Design: A unified Hardware /Software Introduction", John Wiley, New York, 2002.

Course Outcomes:

On completion of the course the students will be able to

- gain a basic appreciation of Embedded system design
- explain the concept of embedded systems, its hardware and its software
- demonstrate the concepts of real time operating systems
- explore programming concepts and embedded programming in C and C++
- describe real time operating systems and inter-task MicroC/OS-II RTOS

14CNT22 HIGH SPEED NETWORKS

(Common to Computer and Communication Engineering & Computer Science and Engineering)

3 0 0 3

UNIT – I **9**

High Speed Networks : Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL- High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT – II **9**

Congestion and Traffic Management: Queuing Analysis- Queuing Models – Single Server Queues – Multi server queues-Effects of congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT – III **9**

TCP and ATM Congestion Control : TCP Flow control – TCP Congestion Control – Retransmission Timer Management – Exponential RTO backoff – KARNs Algorithm – Window management – Performance of TCP over ATM - Traffic and Congestion control in ATM – Requirements – Attributes - Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management

UNIT – IV **9**

Integrated and Differentiated Services : Services- Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNIT – V **9**

Protocols for QoS Support : RSVP – Goals and Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP

TOTAL : 45

REFERENCE BOOKS:

1. Stallings William, “High Speed Networks and Internet”, Second Edition, Pearson Education, New Delhi, 2002.
2. Walrand and Pravin Varaiya, “High Performance Communication Networks”, Second Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
3. Pepelnjak Irvan, Guichard Jim and Apcar Jeff, “MPLS and VPN Architecture”, Cisco Press, Volume 1 and 2, 2003
4. http://pages.cpsc.ucalgary.ca/~carey/CPSC641/archive/Sept2005/

Course Outcomes:

On completion of the course the students will be able to

- develop an in-depth understanding, in terms of architecture, protocols and applications, of major high-speed networking technologies
- solve numerical or analytical problems pertaining to the high-speed networking technologies
- design and configure a network to support a specified set of applications.
- develop necessary background to manage projects involving any of the high-speed networking technologies

14MIE02 INFORMATION RETRIEVAL TECHNIQUES

(Common to Information Technology & Computer Science and Engineering)

3 0 0 3

Pre-requisites: DBMS, DWDM, Web Technology

UNIT – I **9**

Introduction and Classic IR Models : Information Retrieval – The IR Problem – The IR System – Search Interfaces Today-Visualization in Search Interfaces- Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models – Retrieval Evaluation

UNIT – II **9**

Relevance Feedback, Languages and Query Properties: A Framework for feedback methods-Explicit feedback-Implicit feedback through local analysis-Global analysis-Documents: Metadata-Documents formats-Markup languages-Queries.

UNIT – III **9**

Text Operations, Indexing and Searching: Text Properties-Document Preprocessing – Organizing Documents- Text Compression – Text Classification-Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Multidimensional Indexing.

UNIT – IV **9**

Web and Multimedia Information Retrieval: Introduction-The Web-Search Engine Architectures-Ranking-User Interaction-Browsing-Web Crawling-Structured Text Retrieval-Multimedia Information Retrieval.

UNIT – V **9**

Applications: Enterprise Search-Tasks-Architecture-Evaluation- Library Systems-OPAC-IR System and Databases-Digital Libraries.

TOTAL : 45

REFERENCE BOOKS:

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, “Modern Information Retrieval”, 2nd Edition, Pearson Education Asia, 2011.
2. G.G. Chowdhury, “Introduction to Modern Information Retrieval”, Neal-Schuman Publishers, 2nd Edition, 2003.
3. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, Pearson Education, 2000.
4. David A. Grossman, Ophir Frieder, “Information Retrieval: Algorithms, and Heuristics”, Academic Press, 2000.
5. Charles T. Meadow, Bert R. Boyce, Donald H. Kraft, “Text Information Retrieval Systems”, Academic Press, 2000.

Course Outcomes:

On completion of the course the students will be able to

- understand and apply the basic concepts of information retrieval
- appreciate the limitations of different information retrieval techniques
- write programs to implement search engines
- evaluate search engines

14MSE10 INFORMATION STORAGE MANAGEMENT

3 0 0 3

UNIT – I **9**

Storage Systems: Introduction to evolution of storage architecture, key data center elements, virtualization, and cloud computing. Key data center elements – Host (or computer), connectivity, storage, and application in both classic and virtual environments. RAID implementations, techniques and levels along with the impact of RAID on application performance. Components of intelligent storage provisioning and intelligent storage implementations.

UNIT – II **9**

Storage Networking Technologies: Fibre channel SAN components, connectivity options, and topologies including access protection mechanism "Zoning", FC protocol stack, addressing operations, SAN-based virtualization and VSAN technology, iSCS and FCIP protocols for storage access over IP network, Converged protocol FCoE and its components Network Attached Storage (NAS) – components, protocol and operations, File level storage virtualization. Object based storage and unified storage platform.

UNIT – III **9**

Backup, Archive and Replication: Business continuity terminologies, planning and solutions, clustering and multipathing architecture to avoid single points of failure, Backup and recovery – methods, targets and topologies, Data duplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic virtual environments, Remote replication in classic and virtual environment services and deployment models, cloud infrastructure components, cloud migration considerations.

UNIT – IV **9**

Cloud Computing: Business drivers for Cloud computing, Definition of Cloud computing, Characteristics of cloud computing, Steps involved in transitioning from Classic data center to Cloud computing environment services and deployment models, Cloud infrastructure components, Cloud migration considerations.

UNIT – V **9**

Securing and Managing Storage Infrastructure: Security threats, and countermeasures in various domains security solutions for FC-SAN, IP-SAN and NS environments, Security in virtualized and cloud environment, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle management (ILM) and storage tiering, Cloud service management activities.

TOTAL : 45

REFERENCE BOOKS:

1. Networked Storage Concepts and Protocols Techbook (Online Version)
2. Learning Aids on https://education.emc.com/ISMbookv2/default.aspx

Course Outcomes:

On completion of the course the students will be able to

- explore the various storage systems and RAID implementations
- demonstrate the concepts of storage networking technologies.
- apply business continuity solutions – backup and replication, and archive for managing fixed content.
- use and manage cloud storage infrastructure efficiently for real time applications

14MSE11 INTERNET OF THINGS

3 0 0 3

Pre-requisites: Computer Networking Concepts, Wireless Networking Concepts

UNIT – I **9**

Introduction: Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT–Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT – II **9**

IoT Protocols: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT – III **9**

Web of Things: Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture

UNIT – IV **9**

Integrated Solutions: Integrated Billing Solutions in the IoT- Business Models for the IoT - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT – V **9**

Applications: The Role of the IoT for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the IoT: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL : 45

REFERENCE BOOKS:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, (Eds.)," Architecting the Internet of Things", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
4. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

Course Outcomes:

On completion of the course the students will be able to

- design a new model for middleware of IoT based on the market strategy.
- analyze various protocols used in IoT.
- design business intelligence and information security strategies for WoT
- analyze and apply the concepts of IoT and Cloud of Things in real time applications

14MSE12 MACHINE LEARNING TECHNIQUES

3 0 0 3

UNIT – I **9**

Machine Learning: Introduction–Supervised Learning–Learning a Class from Examples–VC Dimension–PAC Learning–Noise–Learning Multiple Classes–Regression–Model Selection and Generalization–Bayesian Decision Theory: Classification–Losses and Risks–Discriminant Functions–Utility Theory–Value of Information–Bayesian Networks–Influence Diagrams- Parametric Methods: Maximum Likelihood Estimation–Evaluating an Estimator–Bayes' Estimator–Parametric Classification–Regression–Tuning Model Complexity–Model Selection Procedures

UNIT – II **9**

Multivariate Methods: Data–Parameter Estimation–Estimation of Missing Values–Multivariate Normal Distribution–Multivariate Classification and Regression- Dimensionality Reduction: Subset Selection– Principal Components Analysis–Factor Analysis–Multidimensional Scaling–Linear Discriminant Analysis- Clustering: k–Means Clustering–Expectation–Maximization Algorithm–Latent Variable Models–Hierarchical Clustering.

UNIT – III **9**

Nonparametric Methods: Nonparametric Density Estimation and Classification-Generalization to Multivariate Data–Condensed Nearest Neighbor–Smoothing Models - Decision Trees: Univariate Trees–Pruning–Rule Extraction–Learning Rules–Multivariate Trees- Linear Discrimination: Generalizing the Linear Model–Geometry of the Linear Discriminant–Pairwise Separation–Parametric Discrimination–Gradient Descent–Logistic Discrimination–Discrimination by Regression–Support Vector Machines

UNIT- IV **9**

Multilayer Perceptrons: Training a Perceptron–Learning Boolean Functions - Back Propagation Algorithm – Training Procedures – Tuning the Network Size – Bayesian View of Learning – Learning Time - Local Models: Competitive Learning – Radial Basis Functions – Rule Based Knowledge – Normalized and Competitive Basis Functions– Learning Vector Quantization – Mixture of Experts

UNIT- V **9**

Classification Algorithms Comparison: Cross–Validation and Resampling–Measuring Error–Interval Estimation–Hypothesis Testing–Assessing a Classification's Performance–Comparing Classification Algorithms– Combining Multiple Learners: Voting–Error–Correcting Output Codes–Bagging–Boosting–Stacked Generalization–Cascading–Reinforcement Learning: Single State Case–Elements of Reinforcement Learning–Model–Based Learning–Temporal Difference Learning–Generalization

TOTAL : 45

REFERENCE BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
4. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2008

Course Outcomes:

On completion of the course the students will be able to

- describe the applications of Machine Learning and different parametric methods
- identify suitable Supervised or Unsupervised learning methods for an application
- apply Neural Networks to solve real world problems

14MSE13 OBJECT ORIENTED SOFTWARE ENGINEERING

(Common to Computer Science and Engineering & Information Technology)

3 0 0 3

Pre-requisites: Software Engineering and Object Oriented Design Concepts

UNIT – I **9**

Introduction to Software Engineering: Introduction - Software Engineering Concepts - Software Engineering Development Activities - Managing Software Development - Modeling with UML - An Overview of UML - Modeling Concepts - A Deeper View into UML - Project Organization and Communication - Project Organization Concepts - Project Communication Concepts - Organizational Activities

UNIT – II **9**

Analysis: Requirements Elicitation – Concepts – Activities - Managing Requirements Elicitation - Case Study - Analysis - Analysis Concepts - Analysis Activities: From Use Cases to Objects - Managing Analysis – Case Study.

UNIT – III **9**

System Design: System Design Concepts - System Design Activities: From Objects to Subsystems - Addressing Design Goals - Managing System Design – Case Study - Object Design - Design Patterns - Reuse Activities: Selecting Design Patterns and Components - Managing Reuse – Case Study - Interface Specification Concepts and activities – Managing Object Design.

UNIT – IV **9**

Implementation and Testing: Mapping Models to Code - Mapping Activities - Managing Implementation – Case study. Testing - Testing Concepts - Testing Activities - Managing Testing. Managing Change - Rationale Management - Rationale Concepts - Rationale Activities: From Issues to Decisions - Managing Rationale.

UNIT – V **9**

Project Management: Introduction - Project Management Concepts - Classical Project Management Activities - Agile Project Management Activities - Software Life Cycle - Introduction: Polynesian Navigation - IEEE 1074: Standard for Developing Life Cycle Processes - Characterizing the Maturity of Software Life Cycle Models - Life Cycle Models

TOTAL : 45

REFERENCE BOOKS:

1 Bernd Bruegge, Alan H Dutoit, “Object Oriented Software Engineering”, Third Edition, Pearson Education, 2012.
2 Craig Larman, “Applying UML and Patterns”, Third Edition, Pearson Education, 2008.
3 Stephan R. Schach, “Software Engineering”, Seventh Edition, Tata Mc Graw Hill, 2007.
4 Stephan R. Schach, “Object oriented software engineering”, First Edition, Tata McGraw Hill, 2004.
5 Roger Pressman, “Software Engineering”, Sixth Edition, Tata McGraw Hill, 2005.
6 Timothy C. Lethbridge, Robert Laganiere, “Object-Oriented Software Engineering Practical Software Development using UML and Java”, First Edition, Tata McGraw Hill, 2006.

Course Outcomes:

On completion of the course the students will be able to

- prepare object oriented design for small/ medium scale problem
- evaluate the appropriate life cycle model for the system under consideration
- apply the various tools and patterns while developing software
- test the software against usability, deployment and maintenance

14MSE14 RANDOMIZED ALGORITHMS

3 0 0 3

Pre-requisites: Design and Analysis of Algorithms, Data Structures and Algorithms

UNIT – I **9**

Introduction: Min-Cut Algorithm, Binary Planar Partitions, **Game-theoretic techniques:** Game Tree Evaluation, The Minimax principle, Randomness and Non-uniformity. **Moments and deviations:** Occupancy Problems, Markov and Chebyshev Inequalities, Randomized Selection, Two-point Sampling, Stable Marriage Problem and Coupon Collector's Problem

UNIT - II **9**

Tail Inequalities: Chernoff Bound, Routing in a parallel Computer, A wiring Problem, Martingales. **The probabilistic method:** Overview, Maximum Satisfiability, Expanding Graphs, Lovasz Local Lemma and Method of Conditional Probabilities.

UNIT – III **9**

Markov Chains and Random Walks: A 2-SAT Example, Markov Chains, Random Walks on Graphs, Electrical Networks, Cover Times, Graph Connectivity, Expanders and Rapidly Mixing Random Walks. **Algebraic techniques:** Fingerprinting and Freivalds Technique, verifying polynomial identities, perfect matchings in graphs, verifying equality of strings, pattern matching, Interactive proof systems

UNIT – IV **9**

Data Structures: Fundamental Data-structuring problem, Random Treaps, Skip Lists, Hash Tables and Hashing. **Graph algorithms:** All-pairs Shortest Paths, Min-cut Problem, Minimum Spanning Trees

UNIT - V **9**

Approximate Counting: Randomized Approximation Schemes, DNF Counting Problem, Volume Estimation. **Parallel and distributed algorithms:** PRAM model and its sorting, Maximal Independent Sets, Perfect Matching, Choice Coordination Problem, Byzantine Agreement

TOTAL : 45

REFERENCE BOOKS:

1. Rajeev Motwani and Prabhakar Raghavan , "Randomized Algorithms", Second Edition, Cambridge University Press, 1995.
2. Michael Mitzenmacher and Eli Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005.
3. Grimmett and Stirzaker, "Probability and Random Processes", Oxford, 2001
4. Feller, William, "An Introduction to Probability Theory and Its Applications", Vol. 1. New York, NY: John Wiley, Third Edition, 1968.

Course Outcomes:

On completion of the course the students will be able to

- understand the basic concepts in the design and analysis of randomized algorithms
- demonstrate basic tools such as probability theory and probabilistic analysis that are frequently used in algorithmic application
- explore the important area to which randomized algorithms can be applied
- choose and apply the appropriate algorithms in various applications

14MSE15 SECURITY PRINCIPLES AND PRACTICES

3 0 0 3

UNIT – I **9**

Introduction to Mathematical Foundations of Cryptography: Integer arithmetic, Modular arithmetic, Congruence and Matrices– Probability and Information theory, Algebraic foundations– Introduction to Number theory

UNIT – II **9**

Symmetric Encryption Techniques and Key Management: Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES – Modes of operation - Key Channel Establishment for symmetric Cryptosystems

UNIT – III **9**

Asymmetric Cryptosystems: The Diffie-Hellman Key Exchange Protocol - Discrete Logarithm Problem- - Public-key Cryptosystems: RSA Cryptosystem and cryptanalysis - Elliptic curve cryptography - ElGamal Cryptosystem -Need for Stronger Security notions for Public-key Cryptosystems. Combination of Asymmetric and Symmetric Cryptography. Key Channel Establishment for Public key Cryptosystems

UNIT – IV **9**

Authentication: Authentication Protocols Principles – Authentication protocols for Internet Security – SSH Remote login protocol – Kerberos Protocol – SSL and TLS – Authentication frame for public key Cryptography- Hash Functions – Security of Hash Functions and MACs – MD5 Message Digest Algorithm - Secure Hash Algorithm - Digital Signature Standard.

UNIT – V **9**

Legal and Ethical issues in Security: Protecting Programs and Data – Information and the Law – Rights of Employees and Employers – Software Failures – Computer Crime – Privacy – Ethical Issues in Computer Security. **Need for security** : The security SDLC - Business needs, threats, attacks - NSTISSC security model, ISO, NIST and VISA models

TOTAL : 45

REFERENCE BOOKS:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.
2. Stallings, William., "Cryptography And Network Security: Principles and Practices", Fourth Edition, Prentice Hall of India, New Delhi, 2003
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2013
4. Whitman. Michael E and Mattord. Herbert J., "Principles of Information Security", Fourth Edition, 2012
5. Behrouz A Forouzan, " Cryptography and Network Security", Second Edition, Tata McGraw Hill Publication, 2010

Course Outcomes:

On completion of the course the students will be able to

- apply the mathematical foundations in security principles
- identify the features of symmetric and asymmetric encryption techniques and authentication
- express the legal and ethical issues of security and need for security practices as well as models

14MSE16 SEMANTIC WEB AND KNOWLEDGE MANAGEMENT

3 0 0 3

Pre-requisites: Web Technology

UNIT – I **9**

Introduction to Semantic Web and RDF: Semantic Web – Need – Technologies – A Layered Approach – Structured Web Documents in XML – Namespaces – Addressing and Querying XML Documents – Processing – RDF - Basic Idea – XML based Syntax – Schema – The Language – RDF and RDF Schema in RDF Schema – An Axiomatic Semantics for RDF and RDF Schema – A Direct Inference System for RDF and RDFS .

UNIT – II **9**

Languages for Semantic Web: RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Web Ontology Language – OWL – OWL in OWL – Ontology Engineering – Constructing Ontologies Manually – Reusing Existing Ontologies – Using Semiautomatic methods – On-To-Knowledge Semantic Web Architecture .

UNIT – III **9**

Knowledge Management and System Life Cycle: KM Myths – KM Life Cycle – Understanding Knowledge–Knowledge, intelligence - Experience – Common Sense – Cognition and KM – Types of Knowledge – Expert Knowledge – Human Thinking and Learning. Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS)– Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge-Creation and Transformation-Knowledge Architecture.

UNIT – IV **9**

Capturing Knowledge and Codification: Evaluating the Expert – Developing a Relationship with Experts–Fuzzy Reasoning and the Quality of Knowledge – Knowledge Capturing Techniques, Brain Storming – Protocol analysis – Consensus Decision Making – Repertory Grid- Concept Mapping Blackboarding. Knowledge Codification: Modes of Knowledge Conversion – Codification Tools and Procedures

UNIT – V **9**

Knowledge Management Testing, System Tools and Portals: Knowledge Testing – Approaches to Logical Testing – Approaches to User Acceptance – Managing the Testing Phase – KM System Deployment – Issues related to Deployment – User Training and Deployment – Post Implementation Review - Data Visualization – Neural Networks As a Learning Model – Association Rules – Classification Trees – Data Mining and Business Intelligence – DM Virtuous Cycle – Data Management – DM in Practice – Role of DM in Customer Relationship – Portal Basics – The Business Challenge – Knowledge Portal Technologies – Knowledge Owners – Legal Issues – The Ethical Factor – Improving the Climate

TOTAL : 45

REFERENCE BOOKS:

1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, "Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web" Springer, 2004
2. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004
3. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer; First Edition, 2002

4. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology – Driven Knowledge Management", John Wiley and Sons Limited, 2003.
5 Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, 2003
6 Elias.M. Award and Hassan M. Ghaziri – "Knowledge Management" Pearson Education
7 Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2001

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the knowledge in semantic web, RDF schema and the languages used
- explore the concepts of knowledge management, capturing and codifying the knowledge
- identify and apply the knowledge management testing, system tools and portals in real time applications
- acquire skills to capture and codify the knowledge

14MIE03 SOCIAL NETWORK ANALYSIS

(Common to Information Technology & Computer Science and Engineering)

3 0 0 3

UNIT – I **9**

Introduction to the semantic web and social networks: Limitations of the current Web – The Semantic Solution – Development of the Semantic Web - The emergence of the social web – Discussion-Development of Social Network Analysis – Key concepts and measures in network analysis.

UNIT – II **9**

Web data and semantics in social network applications: Electronic discussion networks – Blogs and online communities – Web- based Networks- Ontologies and their role in the Semantic Web - Ontology languages for the Semantic Web-State-of-the-art in network data representation – Ontological representation of social relationships – Aggregating and reasoning with social network area- Building semantic web application with social network features – Flink: the social networks of the Semantic web community – open academia: distributed, semantic- based publication management

UNIT – III **9**

Evaluation of web-based social network extraction : Differences between survey methods and electronic data extraction – Context of the empirical study – Data collection- Preparing the data – Optimizing goodness of fit – Comparison across method and networks – Predicting the goodness of fit – Evaluation through analysis- Semantic-based social network analysis in the sciences - Ontologies - emergent semantics in folksonomy systems.

UNIT – IV **9**

Social media mining and search: Discovering Mobile Social Networks by Semantic Technologies – Online Identities and Social Networking – Detecting Communities in Social Networks – Concept of Discovery in Youtube.com using Factorization method – Mining Regional Representative Photos from Consumer – Generated Geotagged Photos – Collaborating Filtering Based on Choosing a Different Number of Neighbors for Each User – Discovering Communities from Social Networks : Methodologies and Applications.

UNIT – V **9**

Social network infrastructures and communities: Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Networks Communities, Privacy in online social networks: Managing Trust in Online Social Networks – Security and Privacy in Online Social Networks – Investigation of Key-Player Problem in Terrorist Network Using Bayes Conditional Probability – Optimizing Targeting of Intrusion Detection System in Social Networks – Security Requirements for Social Networks in Web 2.0- visualization and applications of social networks

TOTAL : 45

REFERENCE BOOKS:

1. Peter mika, "Social networks and the semantic web", Springer publishers, 2007
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer publishers, 2010
3. Guandong Xu , Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer, 1st edition, 2011.

4. Dion Goh and Schubert Foo, "Social information retrieval systems: emerging technologies and applications for searching the Web effectively", IGI Global snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling", IGI Global snippet, 2009.
6. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

Course Outcomes:

On completion of the course the students will be able to

- apply knowledge for current web development in the era of Social Web
- model, aggregate and represent knowledge for Semantic Web
- design extraction and mining tools for Social networks
- develop personalized web sites and visualization for Social networks

14MSE17 SOFT COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Basic knowledge of elementary calculus and linear algebra

UNIT – I **9**

Artificial Neural Network Introduction to Soft Computing, Artificial Neural Network: Supervised Learning Networks, Associative Memory Networks

UNIT - II **9**

Unsupervised Learning Introduction, Fixed weight competitive networks, Kohonen SOM, Learning Vector Quantization, Counter Propagation Network, Adaptive Resonance Theory Network : ART1 and ART2, Special Networks

UNIT – III **9**

Fuzzy Logic: Introduction: Fuzzy Logic, Classical Sets, Fuzzy Sets, Classical Relation and Fuzzy relation, Membership Functions, Defuzzification, Fuzzy Rule-Base and Approximate Reasoning

UNIT– IV **9**

Genetic Algorithm: Introduction, Traditional optimization and search Techniques, Search Space, Operators, Stopping Condition, Constraints, Problem Solving, Schema Theorem, Classification, Holland Classifier System, Genetic Programming

UNIT – V **9**

Hybrid Soft Computing Techniques: Introduction, Neuro-Fuzzy Hybrid System, Genetic-Neuro Hybrid System, Genetic-Fuzzy Hybrid System, Fuzzy-Genetic Hybrid System, Simplified Fuzzy ARTMAP, Application of Soft Computing, CASE Study.

TOTAL : 45

REFERENCE BOOKS:

1. S.N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education.

Course Outcomes:

On completion of the course the students will be able to

- identify and describe soft computing techniques and their roles in building intelligent machines
- recognize the feasibility of applying a soft computing methodology for a particular problem
- identify and select a suitable Soft Computing technology to solve the problem; and construct a solution and implement a Soft Computing solution
- design Soft Computing Systems by hybridizing various other techniques

14MSE18 VIRTUALIZATION TECHNIQUES

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Pre-requisites: Operating system, Networking concepts

UNIT – I **9**

Overview of Virtualization: Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization-Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts

UNIT – II **9**

Server Consolidation: Hardware Virtualization – Virtual Hardware Overview - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform

UNIT – III **9**

Network Virtualization: Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture- WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – IPsec-L2TPv3 Label Switched Paths - Control-Plane Virtualization

UNIT – IV **9**

Virtualizing Storage: SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.

UNIT – V **9**

Virtual Machines Products: Xen Virtual machine monitors- Xen API – VMware – VMware products – VMware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server

TOTAL : 45

REFERENCE BOOKS:

1 William von Hagen, “Professional Xen Virtualization”, Wrox Publications, January, 2008.
2 Chris Wolf , Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress 2005.
3 Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
4 James E. Smith and Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
5 David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

Course Outcomes:

On completion of the course the students will be able to

- create a virtual machine and to extend it to a virtual network.
- demonstrate the various virtual machine products.
- compile all types of virtualization techniques and utilize them in design of virtual machines