KUMARAGURU COLLEGE OF TECHNOLOGY

(Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641049

CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM

(REGULATIONS 2015)

I to IV Semester

M.E

Computer Science and Engineering

Department of Computer Science and Engineering

Vision

To evolve as a centre of excellence with international reputation in the computer science and engineering field to serve the changing needs of industry and society.

Mission

- Computer Science and Engineering department is committed to bring out career oriented graduates who are industry ready by adopting best practices of teaching-learning process.
- To cultivate professional approach, strong ethical values and team spirit along with leadership qualities.
- To contribute towards techno-economic and social development of the Nation

Kumaraguru College of Technology
Coimbatore – 641 049
Regulation 2015

CBCS – PG Curriculum

Name of the PG Programme: M.E

Foundation Courses (FC)

S.No.	Course Code	Course Title	Periods/Wk & Credits				Preferred Semester
			L	T	P	C	
1.	P15MAT109	Advanced Computational Mathematics	4	1	0	4	1

Professional Core (PC)

S.No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
Specilisation 1:							
1.	P15CST101	Advanced Data Structures and Algorithms	4	0	0	3	1
2.	P15CST102	High Performance Computer Architecture	4	0	0	3	1
3.	P15CST103	Software Engineering Methodologies	4	0	2	4	1
4.	P15CST104	Advanced Database Technologies	4	0	2	4	1
5.	P15CSP101	Advanced Data structures lab	0	0	3	1	1
6.	P15CST201	Data Warehousing and Data Mining	4	0	2	4	2
7.	P15CST202	Parallel And Distributed Systems	4	0	0	3	2
8.	P15CST203	Network Engineering and Management	4	0	2	4	2

Professional Electives (PE)

S. No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
1	P15CSTE01	Wireless Security	4	0	0	3	2
2	P15CSTE02	Cloud Computing	4	0	0	3	2
3	P15CSTE03	Information Retrieval Techniques	4	0	0	3	2
4	P15CSTE04	Service Oriented Architecture	4	0	0	3	2
5	P15CSTE05	Mobile and Pervasive Computing	4	0	0	3	2
6	P15CSTE06	Digital Image Processing	4	0	0	3	2
7	P15CSTE07	Machine Learning Techniques	4	0	0	3	2
8	P15CSTE08	Soft Computing	4	0	0	3	2
9	P15CSTE09	Ad hoc and Sensor Networks	4	0	0	3	2
10	P15CSTE10	Video Analytics	4	0	0	3	3
11	P15CSTE11	Big Data Analytics	4	0	0	3	3
12	P15CSTE12	Agent Based Systems	4	0	0	3	3
13	P15CSTE13	Internet Of Things	4	0	0	3	3
14	P15CSTE14	Enterprise Application Integration	4	0	0	3	3
15	P15CSTE15	Semantic Web	4	0	0	3	3
16	P15CSTE16	Web Mining	4	0	0	3	3
17	P15CSTE17	Embedded system Design	4	0	0	3	3
18	P15CSTE18	Natural Language Processing	4	0	0	3	3
19	P15CSTE19	Performance evaluation of computer networks	4	0	0	3	3

Employability Enhancement Courses (EEC)

S. No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
1.	P15CSP201	Mini Project	0	0	6	2	2
2	P15CSP301	Project Work Phase I	0	0	18	6	3
3	P15CSP401	Project Work Phase II	0	0	35	12	4

SEMESTER – I

	Course Code	Course Title	Category	Contact Hours	L	T	P	C
Theory								
1	P15MAT109	Advanced Computational Mathematics	FC	4	3	1	0	4
2	P15CST101	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
3	P15CST102	High Performance Computer Architecture	PC	3	3	0	0	3
4	P15CST103	Software Engineering Methodologies	PC	4	3	0	2	4
5	P15CST104	Advanced Database Technologies	PC	4	3	0	2	4
Practicals								
1	P15CSP101	Advanced Data structures lab	PC	3	0	0	3	1

Total credits : 19

SEMESTER – II

	Course Code	Course Title	Category	Contact Hours	L	T	P	C
Theory								
1.	P15CST201	Data Warehousing and Data Mining	PC	3	3	0	2	4
2.	P15CST202	Parallel And Distributed Systems	PC	3	3	0	0	3
3.	P15CST203	Network Engineering and Management	PC	3	3	0	2	4
4.	E1	Elective I	PE	3	3	0	0	3
5.	E2	Elective II	PE	3	3	0	0	3
6.	E3	Elective III	PE	3	3	0	0	3
Practicals								
1.	P15CSP201	Mini Project	EEC	4	0	0	4	2

Total credits: 22

SEMESTER – III

	Course Code	Course Title	Category	Contact Hours	L	T	P	C
Theory								
1.	E4	Elective IV	PE	3	3	0	0	3
2.	E5	Elective V	PE	3	3	0	0	3
3.	E6	Elective VI	PE	3	3	0	0	3
4.	E7	Elective VII (Self Study / International Certification Course)	PE	-	3	0	0	3
Practicals								
1	P15CSP301	Project Phase 1	EEC	6	0	0	6	3

Total credits : 15

SEMESTER – IV								
	Course Code	**Course Title**	**Category**	**Contact Hours**	**L**	**T**	**P**	**C**
Practicals								
1.	P15CSP401	Project Work	EEC	24	0	0	24	12
Total credits : 12								
Electives								
	Course Code	**Course Title**	**Category**	**Contact Hours**	**L**	**T**	**P**	**C**
Specilisation 1 **								
1	P15CSTE01	Wireless Security	PE*	3	3	0	0	3
2	P15CSTE02	Cloud Computing	PE*	3	3	0	0	3
3	P15CSTE03	Information Retrieval Techniques	PE*	3	3	0	0	3
4	P15CSTE04	Service Oriented Architecture	PE*	3	3	0	0	3
5	P15CSTE05	Mobile and Pervasive Computing	PE*	3	3	0	0	3
6	P15CSTE06	Digital Image Processing	PE*	3	3	0	0	3
7	P15CSTE07	Machine Learning Techniques	PE*	3	3	0	0	3
8	P15CSTE08	Soft Computing	PE*	3	3	0	0	3
9	P15CSTE09	Adhoc and Sensor Networks	PE*	3	3	0	0	3
10	P15CSTE10	Video Analytics	PE*	3	3	0	0	3
11	P15CSTE11	Big Data Analytics	PE*	3	3	0	0	3
12	P15CSTE12	Agent Based Systems	PE*	3	3	0	0	3
13	P15CSTE13	Internet Of Things	PE*	3	3	0	0	3
14	P15CSTE14	Enterprise Application Integration	PE*	3	3	0	0	3
15	P15CSTE15	Semantic Web	PE*	3	3	0	0	3
16	P15CSTE16	Web Mining	PE*	3	3	0	0	3
17	P15CSTE17	Embedded system Design	PE*	3	3	0	0	3
18	P15CSTE18	Natural Language Processing	PE*	3	3	0	0	3
19	P15CSTE19	Performance evaluation of	PE*	3	3	0	0	3

		computer networks						

Total credits : 68

ONE CREDIT COURSES

Sl.No.	Course Title	Industry that will offer the course	L	T	P	C
P15CSIN01	Business Analytics	HCL Technologies, Coimbatore	1	0	0	1
P15CSIN02	Scientific Computing	HCL Technologies, Coimbatore	1	0	0	1
P15CSIN03	Ethical Hacking	HCL Technologies, Coimbatore	1	0	0	1
P15CSIN04	Linux System Administration	HCL Technologies, Coimbatore	1	0	0	1

*** All electives should be only in category PE**

**** Grouping of electives according to specialization is optional**

L	T	P	C
3	1	0	4

P15MAT109 / ADVANCED COMPUTATIONAL MATHEMATICS

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Identify the classification of PDE and its solutions.
CO2: Determine the maximum and minimum values of functional.
CO3: Find the eigen values and eigen vectors of a matrix by various methods.
CO4: Solve the PDE by numerical methods
CO5: Understand the concepts of FEM and the solution of boundary value problems by FEM.

Pre-requisite courses: Numerical methods.

Hrs

PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of second order partial differential equations- Its characteristics and reduction to canonical forms- Solution of second order partial differential equation with variable coefficients by Monge's method- Boundary value problems- Laplace's equation in Cartesian and polar coordinate systems.

CALCULUS OF VARIATIONS 9+3

Euler's equation – Functionals dependent on first and higher order derivatives – Functionals dependent on functions of several dependent variables – Some applications – Direct method: Ritz method.

EIGEN VALUES AND EIGEN VECTORS OF MATRICES 9+3

Concept of Eigen values and Eigen vectors - The power method- The Rayleigh quotient- Inverse iteration- Jacobi's methods- Given and Householder's methods- Faddeev – Leverrier method- Sylvester's expansion theorem and computation of f(A) .

NUMERICAL METHODS 9+3

Solution of Laplace and Poisson equation on a rectangular region by Leibmann's method – Diffusion equation by explicit and Crank Nicolson implicit methods – Solution of wave equation by explicit scheme.

INTRODUCTION TO FINITE ELEMENT METHOD **9+3**

Concepts of finite element methods, nodes, elements - Galerkin's method – solution of boundary value problems by Ritz FEM and Galerkin FEM.

Theory: 45 Hrs **Tutorial: 15 Hrs** **Total Hours: 60**

References:

1. Sankara Rao K., "Introduction to Partial Differential Equations", Prentice Hall of India, Second Edition 2003.
2. Sastry, S.S, "Introductory Methods of Numerical Analysis", Third Edition, Prentice – Hall of India Pvt Ltd, New Delhi, 2003.
3. Kreyszig E., "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Ltd., Singapore, Eighth Edition, 2001.
4. Elsgolts L., "Differential equations and Calculus of variations", University Press of Pacific, 2006.
5. Grewal B.S., "Numerical Methods", Khanna Publishers, Fourth Edition 2007.
6. U.S.Dixit, " Finite element methods for engineering", Edition 2011.
7. D.Cook, S. Malkus, E. Pheston, " Concepts and application of finite element analysis", Fourth Edition.

L	T	P	C
3	0	0	3

P15CST101 / ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Show the ability to analyze algorithms.
CO2: Explain a variety of advanced data structures and their implementations.
CO3: Identify different algorithm design techniques to solve problems.
CO4: Solve problems by implementing learned algorithm design techniques and data structures.
CO5: Explain approximation algorithms and NP-completeness.

Pre-requisite courses: Nil

Hrs

INTRODUCTION 9

The Role of Algorithms in Computing - Getting Started-Growth of Functions – Divide-and-Conquer - The maximum - subarray problem - Strassen's algorithm for matrix multiplication - The Substitution Method for solving recurrences - The Recurrence Tree Method for solving recurrences – The Master Method for solving recurrences – Probabilistic Analysis and Randomized Algorithms - The Hiring Problem- Random Variables - Randomized Algorithms. Amortized Analysis – Aggregate analysis – the accounting method – The potential method – dynamic tables.

ADVANCED DATA STRUCTURES – I 9

Min-max heaps – Deaps – Leftist heaps –Binomial heaps – Fibonacci heaps – Skew heaps – Lazy-binomial heaps.

ADVANCED DATA STRUCTURES – II

9

Optimal Binary search trees – AVL trees – 2-3 trees – 2-3-4 trees – Red-black trees – B-trees – splay trees – Tries

DESIGN AND ANALYSIS TECHNIQUES **9**

Dynamic Programming – Matrix chain multiplication –Elements of Dynamic programming- Longest common sequences Greedy Algorithms-Activity selection problem-Elements of Greedy Strategy-Huffman code.

String Matching – The naïve string-matching algorithm- The Robin-Karp algorithm – String matching with finite automata – The Knuth-Morris-Pratt algorithm.

NP COMPLETE AND APPROXIMATION PROBLEM **9**

NP-Completeness- polynomial time- polynomial time verification - NP-complete problems - Approximation Algorithms-The vertex-cover problem-The traveling-salesman problem – The set-covering problem.

Theory: 45 Hrs **Tutorial: 0** **Total Hours: 45**

References:

1. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Second Edition, Universities Press, Hyderabad, 2008.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, Prentice Hall of India, New Delhi, 2009
3. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, University Press, 2008.
4. David P. Williamson, David B. Shmoys, "The Design of Approximation Algorithms", Cambridge University Press, 2011
5. Jon Kleinberg, "Algorithm Design", Addison-Wesley, 2013.
6. M. Herlihy and N. Shavit, "The Art of Multiprocessor Programming", Morgan Kaufmann, 2012

Other references:

1. http://www.oopweb.com/Algorithms/Files/Algorithms.html
2. http://www.learnalgorithms.in/
3. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
4. http://ocw.mit.edu/courses

L	T	P	C
3	0	0	3

P15CST102 / HIGH PERFORMANCE COMPUTER ARCHITECTURE

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Summarize the performance of a computer and compare it with a benchmark.
CO2: Explain the different compiler techniques for exposing ILP.
CO3: Explain the limitations on ILP for realizable processors.
CO4: Analyze the performance of symmetric shared-memory multiprocessors.
CO5: Outline the various optimization methods of enhancing the cache performance.

Pre-requisite courses: Nil

Hrs

FUNDAMENTALS OF COMPUTER DESIGN 9

Introduction- Classes of Computers- Defining Computer Architecture- Trends in Technology- Dependability- Measuring, Reporting and Summarizing Performance Quantitative Principles of Computer Design. Instruction set Principles**:** Introduction – Classifying Instruction set Architectures- Memory Addressing- Type and Size of Operands- Operations in the Instruction set – Instructions for Control Flow- Encoding an Instruction set.

INSTRUCTION LEVEL PARALLELISM AND ITS EXPLOITATION 10

Pipelining: Introduction- The Major Hurdle of Pipelining — Pipeline Hazards. Instruction Level Parallelism: Concepts and Challenges – Basic Compiler Techniques for Exposing ILP- Reducing Branch Costs with Prediction – Overcoming Data Hazards with Dynamic Scheduling- Hardware Based Speculation- Exploiting ILP using Multiple Issue and Static Scheduling- Exploiting ILP using Dynamic Scheduling, Multiple Issues and Speculation

LIMITS ON ILP 8

Limits on Instruction-Level Parallelism**:** Introduction- Studies of the Limitations of ILP- Limitations on ILP for Realizable processors- Crosscutting Issues**:** Hardware versus Software speculation- Multithreading**:** Using ILP Support to exploit Thread-Level Parallelism. Performance & Efficiency in Advance multiple issue processors.

MULTIPROCESSORS AND THREAD-LEVEL PARALLELISM **9**

Introduction – Symmetric Shared-Memory Architectures- Performance of Symmetric Shared- Memory Multiprocessors- Distributed Shared Memory and Directory-Based Coherence- Synchronization: The Basics- Models of Memory consistency an Introduction- Crosscutting Issues.

MEMORY HIERARCHY DESIGN AND STORAGE SYSTEM **9**

Memory Hierarchy Design**:** Introduction- Eleven Advanced Optimizations of Cache Performance – Memory Technology and Optimizations- Protection: Virtual Memory and Virtual Machines. Storage Systems**:** Introduction- Advanced Topics in Disk Storage- Definition and Examples of Real Faults and Failures-I/O Performance, Reliability Measures and Benchmarks

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. John L. Hennessey and David A. Patterson, "Computer Architecture: A Quantitative Approach", Fifth Edition, Morgan Kaufmann, 2011.
2. D. Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Spac Approach", Addison Wesley, 2009.
3. Kai Hwang, "Advanced computer architecture Parallelism Scalability Programmability", Tata McGraw Hill, 2010.
4. Vincent P.Heuring and Harry F.Jordan, "Computer System Design and Architecture", Addison Wesley, Second Edition, 2008.

L	T	P	C
3	0	2	4

P15CST103 / SOFTWARE ENGINEERING METHODOLOGIES

Course Outcomes

On successful completion of this course, the students should be able to

CO1: Make use of the principles involved in gathering requirements and perform requirements modeling
CO2: Build software architectural models
CO3: Analyse suitable models and arrive at an appropriate software design
CO4: Appreciate the quality assurance procedures by using software metrics
CO5: Analyse Software Project management techniques and software maintenance practices

Pre-requisite courses: Nil

Hrs

INTRODUCTION TO SOFTWARE ENGINEERING 9+3

Software Engineering Discipline, Computer Based Systems, Increasing size and scope of software, Generic vs. Custom-made software products -distinctive characteristics of software products.

Software Development Models: Life cycle, Development process, Life cycle models-Linear Sequential, Evolutionary, Unified models, Agile development approaches.

REQUIREMENTS ENGINEERING 9+3

Classification of Requirements-System Requirements and Software Requirements, Functional and Non-Functional requirements, Priority Categories of Requirements. Requirement Engineering Tasks

System Models: Domain Analysis and Modeling, Data Models, Functional Models-structured Analysis Model, Object Oriented Models- State, Use Case Models, Sequence and activity diagrams, Relationship among the Object Oriented Models

SOFTWARE DESIGN AND IMPLEMENTATION 9+3

Architectural Design-Decomposition strategy, Partitions and Layers, Structured System Design-Use of Heuristics for Design Refinements, Object-Oriented Design-Handling Concurrency, User Interface Design, User Interface Standards and Guidelines. Reusable Components, Patterns, Frame works, Coding – Choice of Programming Language, Coding Standards

SOFTWARE TESTING **9+3**

Conventional Testing and SDLC Testing, Organization for Testing, Formal Technical Reviews, Use of Static Analyzers. Testing during Code Integration, Product Testing System Testing, Testing Distributed Implementation, Testing of Real-Time systems, Acceptance Testing.

Software Quality Management: Quality Dimensions, Process Quality and Product Quality, Quality Assurance Planning, Quality Measurements, Software Configuration Management-Version management, Software Process Improvement-Capability Maturity Model, Other SPI models, Testing Rationale Management, PSP, TSP.

SOFTWARE PROJECT MANAGEMENT **9+3**

Software Projects, Project Planning, Project Organization, Software Estimation, Risk Management. Project Scheduling, Project Monitoring and Control- Measurement during Software Projects.

Software Maintenance: Planning for Maintenance, maintenance Activities, Reverse Engineering and Re-engineering– Case Study of CASE tools.

Component Lab

Practicing the different types of CASE tools such as (Rational Suite & other Open Source tools) used for various phases of SDLC.

L: 45 Hours **Component Lab: 15 Hours** **Total: 60 Hrs**

References:

1. S.Thangasamy, “Essentials of Software Engineering”, Wiley India, First Edition, 2012
2. S. M. Blaha and J. Rumbaugh, “Object Oriented Modeling and Design with UML”, Second Edition, Prentice-Hall India, 2007
3. R.S. Pressman, ”Software Engineering – A Practitioner’s Approach”, Seventh edition, McGraw Hill International Edition, 2010.
4. Watts S. Humphrey, “Managing the Software Process”, First Edition, Addison Wesley, 1989.
5. Stephen Schach, “Software Engineering”, Seventh edition, TMH, New Delhi, 2007
6. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Third edition, Narosa Publishing House, Reprint 2014
7. I Sommerville, “Software Engineering”, Ninth edition, Pearson Education, 2010

L	T	P	C
3	0	2	4

P15CST104 / ADVANCED DATABASE TECHNOLOGIES

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Explain the fundamentals of database management systems.
CO2: Outline the distributed databases and its architecture.
CO3: Summarize object oriented databases and locks with POSTGRES.
CO4: Outline emerging database models like client-server models, data warehousing and data mining.
CO5: Design distributed database systems for a given problems using.

Pre-requisite courses: Nil **Hrs**

RELATIONAL MODEL ISSUES 9+3

ER Model - Normalization – Query Processing – Transaction Processing - Concurrency Control – Recovery.

DISTRIBUTED DATABASES 9+3

Parallel Databases – Inter and Intra Query Parallelism – Distributed Database Features – Distributed Database Architecture – Fragmentation – Distributed Query Processing – Distributed Transactions Processing – Concurrency Control – Recovery – Commit Protocols.

OBJECT ORIENTED DATABASES: 9+3

Introduction to Object Oriented Databases - Approaches - Modeling and Design - Persistence – Query Languages - Transaction - Concurrency – Multi Version Locks – Recovery – POSTGRES – JASMINE – GEMSTONE - ODMG Model.

EMERGING SYSTEMS: 9+3

Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases – Mobile Databases- XML and Web Databases.

CURRENT ISSUES: **9+3**

Rules - Knowledge Bases - Active and Deductive Databases - Multimedia Databases– Multimedia Data Structures – Multimedia Query languages - Spatial Databases

Component Lab

Database Design and Implementation (Mini Project with Front End Tool)

L: 45 Hours **Component Lab: 15 Hours** **Total: 60 Hrs**

References:

1. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation, and management", Pearson Education, Fourth Edition, 2012.
2. Ramesh Elmasri, Shamkant B,Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2011.
3. Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, Sixth edition, McGraw-Hill.2011
4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2012

L	T	P	C
0	0	3	1

P15CSP101 / ADVANCED DATA STRUCTURES LAB

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Develop skills to implement various advanced data structures.
CO2: Develop skills to implement various algorithm design techniques.
CO3: Develop skills to identify appropriate data structures and algorithm design techniques for solving problems.
CO4: Utilize the acquired knowledge to think critically for improvement of the solution.

CO5: Develop applications using various data structures and design techniques.

Pre-requisite courses: Nil

LIST OF EXPERIMENTS:

Implementation of any two of the following Heap structures

- Deaps (Insertion, Delete Min, Delete Max)
- Leftist Heap (All Meldable Priority Queue operations)
- Skew Heap (All Meldable Priority Queue operations)
- Fibonacci Heap (All Meldable Priority Queue operations)

Implementation of any two of the following Search Structures

- AVL Trees (Insertion, Deletion and Search)
- Splay Trees (Insertion, Deletion and Search)
- Tries for any specified alphabet (Insertion, Deletion and Search)
- B-Trees (Insertion, Deletion and Search)

Implementation of the following divide-and-conquer algorithms

- Convex-hull algorithm.
- Strassen's algorithm

Implementation of Huffman code

Implementation of any two of the following problems using approximation algorithm.

- Vertex cover problem
- Traveling salesman problem
- Set-Cover problem
- Subset-sum problem

Total: 24 Hrs

SEMESTER - II

L	T	P	C
3	0	2	4

P15CST201 / DATA WAREHOUSING AND DATA MINING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Explain the concepts of Data Warehousing architecture and implementation.
CO2: Apply the association rules for mining applications.
CO3: Discuss on appropriate Classification/ Clustering techniques for various problems with high dimensional data.
CO4: Discover the knowledge imbibed in the high dimensional system.
CO5: Illustrate various data mining techniques on complex data objects.

Pre-requisite courses: Advanced Database Technologies

Hrs

INTRODUCTION TO DATA WAREHOUSING 8+3

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

DATA WAREHOUSE PROCESS AND ARCHITECTURE 9+3

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends – Business Applications-tools-SAS.

INTRODUCTION TO DATA MINING 9+3

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques –Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation.

CLASSIFICATION AND CLUSTERING **10+3**

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means Hierarchical Methods – distance based agglomerative and divisible clustering, Density-Based Methods – expectation maximization –Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

DATA WAREHOUSING AND DATA MINING SOFTWARE'S AND APPLICATION **9+3**

Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining.

Component Lab

List of Experiments

1. Exercise on Data warehouse design for an enterprise
2. Exercise on Classification Algorithms
3. Exercise on Clustering Algorithms
4. Exercise on Discovering Association Rules
5. Exercises on Data mining tools

L: 45 Hours **Component Lab: 15 Hours** **Total: 60 Hours**

References:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques" , Morgan Kaufmann Publishers, Third edition, 2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMc Graw Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4. Mehmed kantardzic,"Datamining concepts,models,methods, and algorithms", Wiley Interscience, 2003.
5. Ian Witten, Eibe Frank, "Data Mining; Practical Machine Learning Tools and Techniques", Third Edition, Morgan Kaufmann, 2011.
6. George M Marakas, "Modern Data Warehousing, Mining and Visualization", Prentice Hall, 2003.

Other references:

1. http://www.information-management-architect.com/process-architecture.html
2. http://www.cs.ccsu.edu/~markov/ccsu_courses/DataMining-1.html
3. http://www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm
4. http://study.com/academy/lesson/data-warehousing-and-data-mining-information-for-business-intelligence.html

L	T	P	C
3	0	0	3

P15CST202 / PARALLEL AND DISTRIBUTED SYSTEMS

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Apply parallel program design techniques.
CO2: Explain how to access remote objects.
CO3: Understand how to work in the distributed environment.
CO4: Explain synchronization of distributed events using common global clocks.
CO5: Outline the issues involved in distributed transactions.

Pre-requisite courses:
1. Computer Network
2. Algorithms

Hrs

PRINCIPLES OF PARALLEL ALGORITHM DESIGN 9

Decomposition techniques, Characteristics of Tasks and Interactions, Mapping techniques for load Balancing, Parallel Algorithm models, Principles of Message-Passing Programming, MPI.

INTRODUCTION TO DISTRIBUTED SYSTEMS 9

Introduction to Distributed systems-examples of distributed systems- resource sharing and the web-challenges-architectural models- fundamental models – Introduction to inter-process communications-external data representation and marshalling- client server communication-group communication – Case study: IPC in UNIX

DISTRIBUTED OBJECTS AND FILE SYSTEM 9

Introduction – Communication between distributed objects – Remote procedure call – Events and notifications – Java RMI case Study – Introduction to Distributed File System – File service architecture – Sun network file system – The Andrew File system – Introduction to Name Services- Name services and DNS – Directory services.

DISTRIBUTED OPERATING SYSTEM SUPPORT 9

The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Distributed debugging – Distributed mutual exclusion

DISTRIBUTED TRANSACTIONS, REPLICATION AND MULTIMEDIA SYSTEMS **9**

Introduction to distributed transactions - Flat and nested distributed transactions - Concurrency control in distributed transactions - Distributed deadlocks - Replication - System model and group communications – Fault tolerant services – Introduction to Distributed Multimedia systems – Characteristics of multimedia data-Quality of Service management

Theory: 45 Hrs **Tutorial: 0 Hrs** **Total Hours: 45**

References:

1. Ananth Grama, Anushul Gupta, George Karypis and Vipin Kumar, " Introduction to Parallel Computing", Second Edition, Pearson Education, 2008.
2. George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", Fifth Edition, Pearson Education, 2011.
3. A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2007.
4. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2011

Other references:

1. http://www-unix.mcs.anl.gov/dbpp/text/book.html
2. https://computing.llnl.gov/tutorials/mpi/
3. http://mpitutorial.com/beginner-mpi-tutorial/
4. http://www.mcs.anl.gov/research/projects/mpi/tutorial/mpiintro/ppframe.htm
5. http://www.tldp.org/LDP/lpg/node7.html

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P15CST203 / NETWORK ENGINEERING AND MANAGEMENT

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Outline the basic concepts, standards and types of network.

CO2: Explain the operations of various protocols in networks.

CO3: Analyze algorithms for routing and congestion control.

CO4: Develop client - server based applications.

CO5: Outline the basic concepts of network management.

Pre-requisite courses: Nil

Hrs

PHYSICAL AND DATA LINK LAYER 9+3

Network hardware - Network software -OSI reference model -TCP/IP model - wireless transmission- Data link layer design issues- Error detection and correction - Sliding window protocols- Packet over SONET, ADSL.

NETWORK LAYER 9+3

Packet switching - Routing algorithms: Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing - Quality of service (QoS): ISA, DS - Network layer in internet: IPv4, IPv6, ICMP, ARP, RARP, DHCP- VLAN-VPN.

TRANSPORT LAYER 10+3

Addressing - Error Control and Flow Control – Congestion control - Multiplexing - Internet transport protocol: UDP, TCP.

Socket address structure-Byte ordering functions - Elementary TCP socket functions - Concurrent servers - Elementary UDP socket functions - Elementary SCTP sockets - Name and address conversions –Client/ server model of interaction and examples.

APPLICATION LAYER 8+3

Remote login: TELNET - DNS - File transfer and access: FTP, TFTP, NFS - Electronic mail: SMTP, MIME - World Wide Web: HTTP.

NETWORK MANAGEMENT **9+3**

Monitoring and Control – Network Management Systems – Abstract Syntax Notation – CMIP – SNMP Communication Model – SNMP MIB Group – Functional Model – Major changes in SNMPv2 and SNMPv3 – Remote monitoring – RMON SMI and MIB.

Theory: 45Hrs **Practical: 15 Hrs** **Total Hrs:60**

References:

1. Andrew S.Tanenbaum, David J. Wetherall "Computer Networks", Pearson Education, Fifth edition, 2010.
2. Richard Stevens, "UNIX Network Programming, the sockets Networking API", Vol 1, Pearson education Asia, Third edition, 2010
3. Mani Subramaniam, 'Network Management: Principles and Practices', Pearson Education, Second edition,2010
4. Douglas E. Comer, "Internetworking with TCP/IP Volume – I", Fifth Edition, Prentice Hall, 2010.
5. Larry L Peterson and Bruce S Davie, "Computer Networks: A Systems Approach", Fourth Edition, Morgan Kaufman Publishers, Fifth Edition, 2011.

Other reference:

1. http://nptel.ac.in/courses/106105081/

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P15CSTE01 / WIRELESS SECURITY

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Illustrate the different cryptographic techniques for security.
CO2: Analyze the security issues in WLAN, WAP and WTLS.
CO3: Outline the security methods for Bluetooth and VOIP.
CO4: Illustrate the Hardware Perspectives in Wireless Applications.
CO5: Explain the implementation techniques for wireless security.

Pre-requisite courses: Network Engineering and Management

Hrs

CRYPTOGRAPHIC SECURITY 9

Ciphers – PRNG – DES – Attacks – SHA – AES - Key management - generation and distribution of keys - Public key distribution and Diffie Hellman - Discrete logarithm systems – ECC - Comparison of public key cryptographic systems - ECDLP and wireless devices - Key generation in wireless devices for IFP, DLP and ECDLP - Cryptography in embedded hardware: FPGA and ASICs.

WLAN, WAP, WTLS 9

Wireless transmission media - WLAN products and standards - Securing WLANs – Countermeasures - WEP - Physical security - Comparison of TCP/IP, OSI and WAP models - WAP security architecture - Marginal security - Secure socket layer - Wireless transport layer security and WAP.

BLUETOOTH AND VOIP 9

Bluetooth basic specifications - development - Bluetooth security architecture - Scatternets -Security functions at the Baseband layer – Authentication – Encryption - Threats to Bluetooth security - VoIP standards - VoIP technology - Technical issues for VoIP calling - Voice network security vulnerabilities - Confidentiality, Integrity and Availability attributes -VoIP and the wireless security environment.

HARDWARE PERSPECTIVES FOR E2E IN WIRELESS APPLICATIONS 9

Client-server vs Peer-to-peer land-based vs Wireless-based communications - Transmission medium (non-LAN point-to-point, LAN or WAN, or LAN-WAN-LAN) - Encryptor structures in wireless - Interception and vulnerability of wireless systems - Communications ESM and interception receivers - SAW technology - Direct Sequence Spread Spectrum system interception - Frequency hopping systems interception - Modulation recognition and Comint system output processing - Decision theoretical approach - Neural network based approach – Implications -Covert transmission.

OPTIMIZING WIRELESS SECURITY WITH FPGA AND ASIC **9**

Evaluating secure design architectures - Software vs. Hardware implementation of wireless security – On-chip modules - Basic architectures for block cipher crypto engines in a COMSEC chip - Security considerations for the modes during transmission - Protection against catalog attacks - Common techniques for implementing security modules - Embedded generation of random numbers – ECC based Diffie Hellman and Digital signatures - NTRU key generation.

Theory: 45 Hrs **Tutorial: 0 Hrs** **Total Hours: 45**

References:

1 Randall K.Nichols and PanosC.Lekkas, “Wireless Security Models, Threats and Solutions”, Tata McGraw Hill, 2006.

2 Behrouz A. Fourcuzan, ”Cryptography and Network Security”, Tata McGraw Hill, 2008.

3 William Stallings, “Cryptography and Network security: principles and practice", Prentice Hall of India, Second Edition, New Delhi, 2002

4 AtulKahate, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill, 2008

5 H.Yang et al., “Security in Mobile Ad Hoc Networks: Challenges and Solution”, IEEE Wireless Communications, Feb. 2004.

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P15CSTE02 / CLOUD COMPUTING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Outline cloud computing paradigm and its various forms of services.
CO2: Identify the architecture, infrastructure and delivery models of cloud computing.
CO3: Apply suitable virtualization concept.
CO4: Analyze various cloud security and current trends in Resource Allocation.
CO5: Discover the appropriate technologies, algorithms, Programming Models and approaches for the Related issues.

Pre-requisite courses:
1. Network Engineering and Management
2. XML and Web Service

Hrs

INTRODUCTION TO CLOUD COMPUTING AND SERVICES 9

Introduction – History of Cloud Computing – Cloud Architecture- Pros and Cons of Cloud Computing– Companies in the Cloud Today –Technologies for Network-Based System -cloud Services – Characteristics- Cloud models (IaaS, PaaS, SaaS) –Types of Clouds -Public Clouds -Private Clouds - Hybrid Clouds -Community Clouds. Discovering Cloud Services Development Services and Tools, Cloud maturity levels.

CLOUD INFRASTRUCTURE 9

Scalable Computing over the Internet – Technologies for Network based Systems - System Models for Distributed and Cloud Computing – Service Oriented Architecture – NIST Cloud Computing Reference Architecture. Cloud Computing and Services Model – Public, Private and Hybrid Clouds – Cloud Eco System - IaaS -PaaS – SaaS. Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources. Case Study: Amazon Web Service reference, GoGrid, Rackspace

VIRTUALIZATION **8**

Virtualization - Types of Virtualization - Implementation Levels of Virtualization -Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

PROGRAMMING MODEL **10**

Parallel and Distributed Programming Paradigms – MapReduce, Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack. CloudSim – Architecture - Cloudlets – VM creation – Broker – VM allocation – Hosts – Data Center.

SECURITY IN THE CLOUD AND RESOURCE MANAGEMENT **9**

Security Overview – Cloud Security Challenges and Risks– Risk Management – Security Monitoring – Security Architecture-Design – Data Security – Application Security – Virtual Machine Security – Cloud Computing Security Architecture – Trusted cloud Computing Identity Management and Access Control – Autonomic Security. Dynamic Resource Allocation using Virtual Machines for Cloud.

Theory: 45 Hrs **Tutorial: 0 Hrs** **Total Hours: 45**

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Michael Miller, Cloud Computing: Web-Based Applications, Collaborate Online, Que Publishing, August 2008.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.
5. Zhen Xiao, Weijia Song, And Qi Chen, "Dynamic Resource Allocation Using Virtual Machines For Cloud Computing Environment", IEEE Transactions on Parallel and Distributed Systems, Vol. 24, No. 6, June 2013.
6. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", TMGH.

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P15CSTE03 / INFORMATION RETRIEVAL TECHNIQUES

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Build an Information Retrieval system using the available tools
CO2: Identify and design the various components of an Information Retrieval system
CO3: Apply machine learning techniques to text classification and clustering which is used for Efficient Information Retrieval
CO4: Analyze the Web content structure
CO5: Design an efficient search engine

Pre-requisite courses:

1. Data Warehousing and Data Mining, Web Mining, Machine Learning Techniques

Hrs

INTRODUCTION 9

Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models – Structured Text Retrieval Models – Retrieval Evaluation –Word Sense Disambiguation

QUERYING 9

Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis – Text and Multimedia languages

TEXT OPERATIONS AND USER INTERFACE 9

Document Pre-processing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching – User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points –Query Specification - Context – User relevance Judgment – Interface for Search.

MULTIMEDIA INFORMATION RETRIEVAL 9

Data Models – Query Languages – Spatial Access Models – Generic Approach – One Dimensional Time Series – Two Dimensional Color Images – Feature Extraction

APPLICATIONS **9**

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers – Online IR systems – Online Public Access Catalogs – Digital Libraries – Architectural Issues – Document Models, Representations and Access – Prototypes and Standards.

Theory: 45 Hrs **Tutorial: 0 Hrs** **Total Hours: 45**

References:

1. R. Baeza-Yates and B. Ribeiro Neto,"Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, Addison Wesley, 2011.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze," Introduction to Information Retrieval ", Cambridge University Press, 2008.
3. David A.Grossman and Ophir Frieder,"Information Retrieval – Algorithms and Heuristics", Second Edition, Springer International Edition, 2009.

Other references:

1. www.statsoft.com/Textbook/Text-Mining

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P15CSTE04 / SERVICE ORIENTED ARCHITECTURE

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Explain the fundamental principles of SOA.
CO2: Organise the services to perform the service composition.
CO3: Model and design a service-oriented system using architectural principles, development Methods with SOA and related technologies
CO4: Outline the technologies used for SOA implementation
CO5: Demonstrate software development using SOA as a team

Pre-requisite courses: XML and Web Services

Hrs

INTRODUCTION **9**

The Evolution of SOA –Characteristics of SOA – Introducing SOA

WEB SERVICES FUNDAMENTALS, SOA AND WS* EXTENSIONS **9**

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography-addressing-Reliable messing-Correlation-Policies-Metadata Exchange-Security

SOA AND SERVICE ORIENTATION **9**

Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer-Agnostic Services-SOA delivery Strategies

BUILDING SOA **9**

Service oriented analysis – Business-centric SOA – Deriving business services- service Modeling – Service modeling guide lines-Service Oriented Design – WSDL basics – SOAP basics –Service interface design tools– SOA composition guidelines – Entity-centric business service design – Application service design – Task centric business service design -Service design guidelines

SOA PLATFORMS **9**

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC) - Web Services Interoperability Technologies (WSIT) - SOA support in .NET – Common Language Runtime - ASP.NET web forms – ASP.NET web services – Web Services Enhancements (WSE)

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Thomas Erl**, "**Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2011.
2. Thomas Erl, "SOA Principles of Service Design "The Prentice Hall Service-Oriented Computing Series from Thomas Erl, 2005
3. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005
4. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services, An Architect's Guide", Pearson Education, 2005.
5. Dan Woods and Thomas Mattern, "Enterprise SOA Designing IT for Business Innovation" O'REILLY, First Edition, 2006.

Other references:

1. www.oracle.com/technetwork/systems/**soa**2-137288.html
2. www.youtube.com/watch?v=Suf5FbTT7T8
3. https://www.opengroup.org/**soa**/source-book/**soa**_refarch/**concept**s.html

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P15CSTE05 / MOBILE AND PERVASIVE COMPUTING

Course Outcomes (COs):

CO1: Explain emerging technologies in wireless networks.
CO2: Explain about the transmission methods and data management.
CO3: Compare the working of wireless routing protocols.
CO4: Develop Markup language for wireless application protocols.
CO5: Outline the characteristics of pervasive computing applications including the major system components and architectures of the systems.

Pre-requisite courses:
P15CST203- Network Engineering and Management

INTRODUCTION **Hrs 9**

Wireless networks- emerging technologies- Blue tooth, WiFi, WiMAX, 3G ,WATM.-Mobile IP protocols -WAP push architecture-Wml scripts and applications.

MOBILE COMPUTING **8**

Mobile computing environment—functions-architecture-design considerations, content architecture - CC/PP exchange protocol, context manager. Data management in WAE-Coda file system- caching schemes- Mobility QOS. Security in mobile computing.

LOCATION MANAGEMENT **8**

Handoff in wireless mobile networks-model-handoff schemes. Location management in cellular networks - Mobility models- location and tracking management schemes- time, movement, profile and distance based update strategies. ALI technologies.

PERVASIVE COMPUTING **10**

Pervasive Computing- Principles, Characteristics- interaction transparency, context aware, automated experience capture. Architecture for pervasive computing- Pervasive devices-embedded controls.- smart sensors and actuators -Context communication and access services

SERVICE DISCOVERY **10**

Open protocols- Service discovery technologies- SDP, Jini, SLP, UpnP protocols–data synchronization- SyncML framework - Context aware mobile services -Context aware sensor networks, addressing and communications. Context aware security

Theory:45Hr **Tutorial: 0 Hr** **Total Hours:45**

References:

1 Ivan Stojmenovic , Handbook of Wireless Networks and Mobile Computing, John Wiley & sons Inc, Canada, 2002.

2 Asoke K Taukder,Roopa R Yavagal,Mobile Computing, Tata McGraw Hill Pub Co. , New Delhi, 2005.

3 Seng Loke, Context-Aware Computing Pervasive Systems, Auerbach Pub., New York, 2007.

4 Uwe Hansmann etl , Pervasive Computing, Springer, New York,2001.

5 Frank Adelstein Sandeep K. S. Gupta Golden G. Richard III Loren Schwiebert "Fundamentals of Mobile and Pervasive Computing, ", McGraw-Hill, 2005

6 Jochen Burthardt et al, 'Pervasive Computing: Technology and Architecture of Mobile Internet Applications', Pearson Education, 2009

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P15CSTE06 / DIGITAL IMAGE PROCESSING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Explain digital image processing fundamentals, sampling and quantization concepts for 2D images.
CO2: Apply image processing techniques in both the spatial and frequency domains using various transform techniques.
CO3: Summarize algorithms for smoothening, sharpening and segmentation of 2D images.
CO4: Apply various image processing techniques for real time applications.
CO5: Explain the basics of Color image processing.

Pre-requisite courses: Nil

Hrs

INTRODUCTION 9

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

IMAGE PROCESSING OPERATIONS 9

Arithmetic operations – Logical operations- Geometrical operations–Interpolation techniques - 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.

IMAGE RESTORATION AND SEGMENTATION 9

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.
Edge detection – Types of edge detectors - Segmentation based on threshold- Region based: Region rowing-Region splitting and merging.

IMAGE MORPHOLOGY AND COMPRESSION **9**

Need for morphological processing–Morphological operators–Hit or Miss Transform–basic morphological algorithms: Boundary extraction– Noise removal–Thinning–Thickening– Skeletonization. Need for Compression-Run length encoding-Huffman coding-Arithmetic coding –Predictive Coding-Transform based compression-Vector quantization-Block truncation coding-Wavelet based image compression.

IMAGE REPRESENTATION AND COLOR IMAGE PROCESSING **9**

Representation: chain codes– polynomial approximations–signatures– boundary descriptors– Regional descriptors: Texture regional descriptor.
Light and color-Color formation: Additive and subtractive, color models- Histogram equalization- Color image segmentation.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, New York, 2009.
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, First Edition, 2009.

Other references:

1. www.tutorialspoint.com/dip/
2. eeweb.poly.edu/~onur/lectures/lectures.html

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P15CSTE07 / MACHINE LEARNING TECHNIQUES

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Explain theory underlying machine learning
CO2: Construct algorithms to learn linear and non-linear models
CO3: Implement data clustering algorithms
CO4: Construct algorithms to learn tree and rule-based models
CO5: Apply reinforcement learning techniques for real life problems

Pre-requisite courses: Nil

Hrs

FOUNDATIONS OF LEARNING 9

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve

LINEAR MODELS 9

Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – going beyond linearity – generalization and overfitting – regularization – validation

DISTANCE-BASED MODELS 9

Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees – locality sensitive hashing– non-parametric regression – ensemble learning – bagging and random forests – boosting – meta learning

TREE AND RULE MODELS **9**

Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning

REINFORCEMENT LEARNING **9**

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal-difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AML Book Publishers, 2012.
2. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.
3. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
4. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
5. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
6. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012.

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P15CSTE08 / SOFT COMPUTING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines
CO2: Recognize the feasibility of applying a soft computing methodology for a particular problem
CO3: Identify and select a suitable classification/clustering algorithm to solve the problem
CO4: Apply evolutionary algorithms and Fuzzy logic to solve the problem
CO5: Design soft computing systems by hybridizing various other techniques

Pre-requisite courses: Nil

Hrs

INTRODUCTION TO FUZZY SETS AND FUZZY LOGIC SYSTEMS 9

Fuzzy sets and Fuzzy logic systems- Classical Sets and Fuzzy Sets and Fuzzy relations- Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.
Membership functions: Features of membership functions, standard forms and boundaries, different fuzzification methods
Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.

FUZZY RULE BASED SYSTEMS 9

Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication- Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models.
Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting

INTRODUCTION TO NEURAL NETWORKS 9

Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.
Learning Methods: Hebbian, competitive, Boltzman etc.,
Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks.

Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks.

GENETIC ALGORITHMS **9**

Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA)

Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.

HYBRID SOFT COMPUTING TECHNIQUES **9**

Introduction - Neuro-Fuzzy modelling-Applications of Neural Networks- Pattern Recognition and classification Genetic-Neuro Hybrid System, Genetic-Fuzzy Hybrid System, Fuzzy-Genetic Hybrid System, Simplified Fuzzy ARTMAP, Application of Soft Computing, CASE Study.

Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Samir Roy, Udit Chakroborthy, "Introduction to soft computing - neuro-fuzzy and genetic algorithm", Person Education, 2013
2. Timothy J.Ross, "Fuzzy Logic with Engineering applications", Tata McGraw Hill New York, Third edition, 2010.
3. David E.Goldberg, "Genetic Algorithms in Search Optimization and Machine Learning" , Pearson Education, 2007.
4. J.-S.R Jang., C.-T Sun., & E. Mizutani, "Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence", Prentice-Hall of India Pvt. Ltd., 2005.

Other references:

1. http://www.scholarpedia.org/article/Particle_swarm_optimization
2. http://msdn.microsoft.com/en-us/magazine/hh335067.aspx
3. http://www.scholarpedia.org/article/Biologically_inspired_robotics
4. http://ocw.mit.edu/courses

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P15CSTE09 / ADHOC AND SENSOR NETWORKS

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Summarize the issues and classifications of adhoc and sensor networks.
CO2: Explain various unicast and multicast routing protocols.
CO3: Illustrate the security issues in adhoc networks and explain solutions for it.
CO4: Explain about power management and it schemes.
CO5: Summarize the sensor routing, localizations and QoS issues and solutions.

Pre-requisite courses:

P15CST203-Network Engineering and Management

AD-HOC MAC **Hrs 9**

Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

ROUTING PROTOCOLS **9**

Design issues – Classification – DSDV – WRP – Cluster Head Gateway Protocol – DSR – AODV – TORA – Location Aided Routing – Zone Routing Protocol – Hierarchical State Routing Protocol – Power Aware Routing Protocol.

MULTICAST ROUTING **9**

Design issues – Operation – Classification – Multicast Routing Based a ZRP – Associativity Based Multicast Routing Protocol – Multicast AODV – On-Demand Multicast Routing Protocol – Application – Dependent Multicast Routing.

SECURITY AND ENERGY MANAGEMENT **10**

Security in Adhoc Wireless Networks – Network Security Requirements - Issues and Challenges in Security Provisioning – Network Security Attacks

Energy Management- Need, classification of battery management schemes, Transmission power managementschemes, System power management schemes.

WIRELESS SENSOR NETWORKS ROUTING, LOCALIZATION & QOS **8**

Architecture, Data dissemination, Date gathering, MAC protocols, Localization – Indoor and Sensor Network Localization. QoS in WSN.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1 C.Siva Ram Murthy and B.Smanoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.

2 Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.

3 C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002

4 Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley, 2007

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P15CSTE10 /VIDEO ANALYTICS

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Explain about Video Acquisition, Representation and Storage.
CO2: List various Feature Extraction Methods.
CO3: Assess the process of Reconstruction from Internet photos.
CO4: Explain the Face Detection and Localization process.
CO5: List the applications of Video Segmentation.

Pre-requisite courses: Nil

Hrs

IMAGE AND VIDEO ACQUISITION, REPRESENTATION AND STORAGE 9

Introduction - Human Eye Physiology - Structure of the Human Eye - Image Acquisition Devices - Digital Camera - Color Representation - Human Color Perception - Color Models - Image Formats - Image File Format Standards - JPEG Standard - Video Principles - MPEG Standard - Further MPEG Standards

FEATURE EXTRACTION METHODS AND MANIFOLD LEARNING METHODS 9

Introduction - The Curse of Dimensionality-Data Dimensionality - Local Methods - Global Methods - Principal Component Analysis - Nonlinear Principal Component Analysis -Independent Component Analysis - Statistical Independence - ICA Estimation - ICA by Mutual Information Minimization - FastICA Algorithm - Multidimensional Scaling Methods -Sammon's Mapping - Manifold Learning - The Manifold Learning Problem - Isomap - Locally Linear Embedding – Laplacian Eigenmaps

STRUCTURE FROM MOTION 9

Triangulation - Two-frame structure from motion - Projective reconstruction - Self-calibration -application: View morphing - Factorization - Perspective and projective factorization - Application: Sparse 3D model extraction - Bundle adjustment - Exploiting sparsity- Application: Match move and augmented reality - Uncertainty and ambiguities - Application: Reconstruction from Internet photos - Constrained structure and motion - Line-based techniques - Plane-based techniques

AUTOMATIC FACE RECOGNITION **9**

Introduction - Face Recognition: General Approach - Face Detection and Localization - Face Segmentation and Normalization with TorchVision - Lighting Normalization - Center/Surround Retinex - Gross and Brajovic's Algorithm - Normalization with TorchVision- Feature Extraction - Holistic Approaches - Local Approaches - Feature Extraction with TorchVision - Classification - Performance Assessment - The FERET Database - The FRVT database - Experiments - Data and Experimental Protocol - Euclidean Distance -based Classifier - SVM-based Classification

VIDEO SEGMENTATION AND KEYFRAME EXTRACTION **9**

Introduction - Applications of Video Segmentation - Shot Boundary Detection - Pixel-based Approaches - Block-based Approaches - Histogram-based Approaches -Clustering-based Approaches - Performance Measures - Shot Boundary Detection with Torchvision- Keyframe Extraction - Keyframe Extraction with Torchvision and Torch.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Francesco Camastra Alessandro Vinciarelli, "Machine Learning for Audio, Image and Video Analysis", Springer, First Edition., 2010
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, First Edition., 2010 (unit -IV)
3. David A. Forsyth and Jean Ponce, "Computer Vision- A Modern Approach", PHI, 2009.
4. Alan Hanjalic, "Content-Based Analysis of Digital Video", Springer; 2004

Other references:

1. www.scimagojr.com/journalsearch.php?q=24161&tip=sid
2. https://www.cabrillo.edu/~dbrown/tracker/
3. en.wikipedia.org/wiki/Video_motion_analysis

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P15CSTE11 / BIG DATA ANALYSIS

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Define the key role of Big data Analytics. [K1]
CO2: Explain Hadoop Distributed File System and its components. [K2]
CO3: Solve the basic Analysis problem using Map and reduce [K3]
CO4: Construct different format of data using map reduce split up. [K3]

CO5: Explain Streams in Big Data Analytics. [K2]

Pre-requisite courses: Database Management Systems

Hrs

INTRODUCTION -DATA ANALYTICS LIFECYCLE **9**

Big Data Overview - State of the practice in analytics - The role of the Data Scientist - Big Data Analytics in Industry Verticals, Big data sources. Key roles for a successful analytic project - Main phases of the lifecycle - Developing core deliverables for stakeholders.

OVERVIEW OF HADOOP **9**

Introduction to Hadoop - The Design of HDFS – HDFS Concepts-Blocks Name Nodes and Data Nodes Components of Hadoop- -Hadoop Cluster Architecture-Batch Processing- Serialization Hadoop ecosystem of tools.

MAPREDUCE FRAMEWORK **10**

MapReduce Basics - Functional Programming Roots - Mappers and Reducers - The Execution Framework -MapReduce Algorithm Design –Shuffling, Grouping ,Sorting- Custom Partitioners and Combiners-How Map Reduce Works

MAPREDUCE FORMATS **10**

Default Map Reduce Job- Input Splits – Block Size vs Split size -Input Output formats- Text, Sequence file input /output, NLine input format, Multiline input format. –Built in and User Defined- Joins-Mapside & Reduce Side Joins-Side Data Distribution-Using Job Configuration-Distributed Cache-Application Development using Map Reduce

ADVANCED DATA ANALYTICS **9**

Data Analytics in Rest vs Motion - How stream works-Streams Processing Language – Different operators in Streams – Applications.

L: 45 Hours **T: 0 Hour** **Total: 45 Hours**

References:

1 Noreen Burlingame, "Little Book of Big Data" Kindle Edition.2012

2 Tom White, "Hadoop the definitive Guide", O'Reilly Media yahoo Press, 2nd Edition,2010.

3 Alex Holmas, "Hadoop in Practice", Manning Publications, 2012.

4 Donald Miner, "Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and other systems", O'Reilly Media,2012

5 Nathan Marz, "Big Data: Principles and best practices of scalable real-time data systems", Meaning publications, 2012

4 EJB web references:

- Big Data Analytics in Industry Verticals: mailto:www.ibmbigdatahub.com/.../industry-vertical-analysis-healthcare-and-bi...
- Introduction to Hadoop: opensource.com/life/14/8/**intro**-apache-**hadoop**-big-data
- Hadoop Cluster Architecture : saphanatutorial.com/hadoop-cluster-architecture-and-core-components/
- MapReduce Algorithm Design: mailto:https://lintool.github.io/MapReduceAlgorithms/ed1n.html
- Streams Processing Language:
- www-01.ibm.com/...3.1...streams...tutorial.../tutorial-container.html

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P15CSTE12 / AGENT BASED SYSTEMS

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Describe the working of intelligent agents and reasoning agents
CO2: Explain how communication takes place between agents in a multi-agent environment.
CO3: Discuss a few applications of multi-agent systems.
CO4: Identify the methods for making agents to work together.
CO5: Summarize the basic features of JADE and develop simple programs using it

Pre-requisite courses: Nil

INTRODUCTION **Hrs 9**

Intelligent Agents-Deductive reasoning Agents – Agents as theorem provers- Agent Oriented Programming - Concurrent MetateM- Practical Reasoning Agents

TYPES OF AGENTS **10**

Reactive and Hybrid Agents - Brook's and Subsumption Architecture –The Limitations of Reactive Agents - Hybrid Agents.
Communication - Speech Acts - Agent Communication Languages.
Working Together - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing- Coordination – Multi agent Planning and Synchronization.

MULTI-AGENT INTERACTIONS **9**

Making group decisions- Co-operative games - Allocating scarce resources

BARGAINING **8**

Bargaining for resource division, task allocation and resource allocation - Arguing – Abstract, deductive, dialogue and implemented argumentation systems –Applications – Agents for different domains

JADE **9**

The JADE Platform – Programming with JADE – Basic Features

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1 Michael Wooldridge, "An Introduction to MultiAgent Systems", II edition, John Wiley & Sons, Ltd. 2009.

2 Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi agent Systems with JADE, John Wiley and Sons Ltd, 2007.

3 Gerhard Weiss, "Multi Agent Systems: A Modern Approach to Distributed Artificial Intelligence", The MIT press, 2000.

Other references:

1. http://www.ru.lv/~peter/zinatne/ebooks/Gerhard%20Weiss%20-%20Multiagent%20Systems%20-%20A%20Modern%20Approach%20To%20Distributed%20Artificial%20Intelligence.pd

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P15CSTE13 / INTERNET OF THINGS

Course Outcomes (COs):

After successful completion of this course, students should be able to

CO1: Identify and design the new models for market strategic interaction.
CO2: Develop business intelligence and information security for Internet of Things(IoT).
CO3: Compare various protocols for IoT.
CO4: Develop a middleware for IoT.
CO5: Develop different models for network dynamics.

Pre-requisite course: P15CST203- Network Engineering and Management

Hrs

INTRODUCTION **10**

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.

IOT PROTOCOLS **8**

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

WEB OF THINGS **10**

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

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INTEGRATED **9**

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

APPLICATIONS **8**

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

Theory:45 Hrs **Tutorial: 0 Hr** **Total Hours:60**

References:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "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.

Other Reference:

1. http://nptel.ac.in/courses/106105081/

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P15CSTE14 / ENTERPRISE APPLICATION INTEGRATION

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Enumerate approaches to enterprise applications integration.
CO2: Outline the application integration process for a problem.
CO3: Explain message based integration.
CO4: Identify appropriate integration software for a given design problem.
CO5: Apply integration approaches for specific requirements.

Pre-requisite courses: Nil

Hrs

INTRODUCTION **9**

Services in Software - Business Problem Addressed by SOA - File-Based Data Sharing – Sockets- Three Types of Function Calls - Types of Functions -Restricted RPC - Remote Procedure Call (RPC) -Port Mapper.

INTEGRATION PATTERNS **9**

CORBA Overview - CORBA Model- Application Servers- Messaging Overview - Channels - Messages - End Points- Routing and Scalable Connectivity - Protocol Transformation - Data/Message Transformation - Core Functionalities - Optional Features - Logical Components - Deployment Configurations - Types of ESBs - Practical Usage Scenarios

INTEGRATING APPLICATIONS **9**

Mainframe Application Types - Preliminaries - Summary of Point-to-Point Integration - ESB-based Integration Options- Integrating Package Applications – Adapters- J2EE Connector Architecture (JCA) - Introduction to SAP and Its Interfaces- WebSphere Adapter for SAP Software - Exposure as Web Services

WEB SERVICES

9

XML Namespaces - XML Schemas - XML Processing/Parsing Models- SOAP Messages - SOAP Elements - SOAP Attributes and Processing Model - SOAP Message Exchange Types - SOAP HTTP Binding-WSDL overview - Containment Structure - Elements of Abstract Interface Description - Elements of the Implementation Part - Logical Relationships - SOAP Binding

DEVELOPING WEB SERVICES **9**

UDDI Registry Overview and Basic Data Model -tModel- Categorization and Identification Schemes - Binding Template - Use of WSDL in the UDDI Registry -Web Services Implementation Choices - Building Web Service Clients - Building Web Services - Bottom-Up Approach - Commercial Tools- Overview of Integration Through Service Composition (BPEL)

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Waseem Roshen, "SOA Based Enterprise Integration", Tata McGraw Hill, 2009.

2. George Mentzas and Andreas Frezen (Eds), "Semantic Enterprise Application Integration for Business Processes: Service-oriented Frameworks", Business Science Reference, 2010

3. G.Hohpe and B.Woolf, "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", Addison Wesley Professional, 2003.

4. D.Linthicum, "Next Generation Application Integration: From Simple Information to Web Services", Addison Wesley, 2003.

5. Kapil Pant and MatiazJuric, "Business Process Driven SOA using BPMN and BPEL: From Business Process Modeling to Orchestration and Service Oriented Architecture", Packt Publishing, 2008.

Other references:

1. http://searchsoa.techtarget.com/definition/service-oriented-integration

2. http://docs.oracle.com/javaee/6/tutorial/doc/bncdq.html

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P15CSTE15 / SEMANTIC WEB

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Show the overall architecture of the Semantic Web.
CO2: Identify the component technologies of the Semantic Web and explain their roles.
CO3: Illustrate the design principles of the Semantic Web by applying the technologies.
CO4: Outline certain limitations of the Semantic Web technologies.
CO5: Identify the kinds of services semantic web can and cannot deliver.

Pre-requisite courses:

1. HTML and XML
2. Java programming basics

Hrs

INTRODUCTION TO SEMANTIC WEB — 9

Semantic Web Concepts- Need for the Semantic Web- Information Overload - Stovepipe Systems - Poor Content Aggregation - XML and the Semantic Web - Web Services and the Semantic Web - Current Applications of the Semantic Web - Business Case for the Semantic Web Decision Support - Business Development- Information Sharing and Knowledge.

XML AND WEB SERVICES — 9

XML Basics - Well-Formed and Valid Documents - XML Schema - XML Namespaces - Document Object Model (DOM) - Use of Web Services - Basics of Web Services - SOAP – UDDI

UNDERSTANDING THE RESOURCE DESCRIPTION FRAMEWORK — 9

Capturing Knowledge with RDF - Other RDF Features - RDF Schema – Non-contextual Modeling. Taxonomies: Overview of Taxonomies - Use of Taxonomies - Defining the Ontology Spectrum - Thesaurus, Logical Theory - Ontology - Topic Maps Standards and Concepts – Occurrence – Association - Subject Descriptor – Scope.

ONTOLOGIES — 9

Overview of Ontologies - Ontology Example – Definitions – Syntax – Structure – Semantics - and Pragmatics - Expressing Ontologies Logically - Ontology and Semantic Mapping Problem.

KNOWLEDGE REPRESENTATION **9**

Languages - Formalisms, Logics - Semantic Networks, Frame- Based KR, and Description Logics - Ontology Design and Management using the Protege editor - Ontology Reasoning with Pellet, Ontology Querying with SPARQL - Ontology Programming with the Jena API - Emerging Semantic Web Ontology Languages using Protégé tool.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Paul Groth, Frank van Harmelen, Rinke Hoekstra, "A Semantic Web Primer", Third Edition, MIT press, 2012.
2. Gómez-Pérez, A. Fernández-López, M. Corcho, O. Ontological Engineering. Springer Verlag 2003.
3. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Fourth Edition, Willey Publishing, 2003.
4. John Davies, Rudi Studer, Paul Warren ,"semantic web technologies: Trends and Research in ontology-based systems", Wiley & Sons (July 11, 2006).
5. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd edition, Elsevier Inc, 2011.

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P15CSTE16 / WEB MINING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Identify the different components of a web page that can be used for mining
CO2: Apply machine learning concepts to web content mining
CO3: Design a system to collect information available on the web to build Recommender systems
CO4: Analyze social media data using appropriate data/web mining techniques
CO5: Build a simple search engine using available open source tools

Pre-requisite courses: Data Warehousing and Data Mining

Hrs

INTRODUCTION **8**

Introduction – Web Mining – Theoretical background –Algorithms and techniques – Association rule mining – Sequential Pattern Mining -Information retrieval and Web search – Information retrieval Models- Relevance Feedback- Text and Web page Pre-processing – Inverted Index – Latent Semantic Indexing – Web Search – Meta-Search – Web Spamming

WEB CONTENT MINING **10**

Web Content Mining – Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers. Unsupervised Learning - K-means Clustering - Hierarchical Clustering –Partially Supervised Learning – Markov Models - Probability-Based Clustering - Evaluating Classification and Clustering – Vector Space Model – Latent semantic Indexing – Automatic Topic Extraction - Opinion Mining and Sentiment Analysis – Document Sentiment Classification

WEB LINK MINING **9**

Web Link Mining – Hyperlink based Ranking – Introduction of Social Networks Analysis- Co-Citation and Bibliographic Coupling - Page Rank -Authorities and Hubs -Link-Based Similarity Search - Enhanced Techniques for Page Ranking - Community Discovery – Web Crawling -A Basic Crawler Algorithm- Implementation Issues- Universal Crawlers- Focused Crawlers- Topical Crawlers- Evaluation - Crawler Ethics and Conflicts - New Developments

STRUCTURED DATA EXTRACTION **8**

Structured Data Extraction: Wrapper Generation – Preliminaries- Wrapper Induction- Instance-Based Wrapper Learning ·- Automatic Wrapper Generation: Problems - String Matching and Tree Matching - Multiple Alignment - Building DOM Trees - Extraction Based on a Single List Page and Multiple pages- Introduction to Schema Matching - Schema-Level Match -Domain and Instance-Level Matching – Extracting and Analyzing Web Social Networks

WEB USAGE MINING **10**

Web Usage Mining - Click stream Analysis -Web Server Log Files - Data Collection and Pre- Processing - Cleaning and Filtering- Data Modeling for Web Usage Mining - The BIRCH Clustering Algorithm - Affinity Analysis and the A Priori Algorithm – Binning - Discovery and Analysis of Web Usage Patterns – Modeling user interests –Probabilistic Latent Semantic Analysis – Latent Dirichlet Allocation Model– Applications- Collaborative Filtering- Recommender Systems – Web Recommender systems based on User and Item – PLSA and LDA Models.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Bing Liu, “Web Data Mining, Exploring Hyperlinks, Contents and Usage Data”, Springer, Second Edition, 2011.
2. Guandong Xu ,Yanchun Zhang, Lin Li, “Web Mining and Social Networking: Techniques and Applications”, Springer, First Edition.2010.
3. Zdravko Markov, Daniel T. Larose, “Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage”, John Wiley & Sons, Inc., 2007.
4. Soumen Chakrabarti, “Mining the Web: Discovering Knowledge from Hypertext Data”, Morgan Kaufmann Edition, 2003.

Other references:

http://ocw.mit.edu/courses

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P15CSTE17/EMBEDDED SYSTEM DESIGN

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Explain about the detailed hardware and software design
CO2: List various types of testing for embedded software
CO3: Assess memory organization for effective partitioning
CO4: Explain the benefits of real time tracing
CO5: Compare host based debugging and remote debugging

Pre-requisite courses: Nil

Hrs

EMBEDDED DESIGN LIFE CYCLE 9

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs Micro Controller – Performance tools – Benchmarking – RTOS Micro Controller – Performance tools – Benchmarking – RTOS availability – Tool chain availability – Other issues in selection processes.

PARTITIONING DECISION 9

Hardware / Software duality – Coding hardware – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization – System startup – Hardware manipulation - memory mapped access – speed and code density

INTERRUPT SERVICE ROUTINES 9

Watchdog timers – Flash Memory – A basic toolset – Host based debugging – Remote debugging – ROM emulators – Logic analyzer – Caches – Computer optimization – Statistical profiling.

IN-CIRCUIT EMULATORS 9

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

TESTING **9**

Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance - case study of a real time application.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Arnold S. Berger, "Embedded System Design", CMP books, USA, 2002.
2. Sriram V Iyer, Pankaj Gupta, "Embedded Real time System Programming", Tata Mc Graw Hill, 2008.
3. Arkin, R.C., Behaviour-based Robotics, The MIT Press, 1998.
4. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003.
5. Daniel W Lewis, "Fundamentals of Embedded Software", Pearson Education Asia, 2001.
6. Steve Heath, "Embedded System Design", Elsevier, Second Edition, 2004

Other references:

1. www.embedded.com
2. en.wikibooks.org/wiki/Embedded_Control_Systems_Design

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P15CSTE18 / NATURAL LANGUAGE PROCESSING

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Demonstrate an understanding of Natural Language Processing tasks in syntax, semantics, and pragmatics
CO2: Demonstrate an understanding of Morphology and Part of Speech Tagging
CO3: Show how syntax parsing techniques can be used
CO4: Explain the use of semantic analysis methods
CO5: Relate a few applications of NLP

Pre-requisite courses: Nil

Hrs

INTRODUCTION 9

Natural Language Processing tasks in syntax, semantics, and pragmatics–Issues- Applications-The role of machine learning-Probability Basics–Information theory–Collocations-N-gram Language Models – Estimating parameters and smoothing- Evaluating language models.

MORPHOLOGY AND PART OF SPEECH TAGGING 9

Linguistic essentials-Lexical syntax- Morphology and Finite State Transducers-Part of speech Tagging-Rule-Based Part of Speech Tagging- Markov Models- Hidden Markov Models–Transformation based Models-Maximum Entropy Models. Conditional Random Fields

SYNTAX PARSING 9

Syntax Parsing-Grammar formalisms and tree banks –Parsing with Context Free Grammars- Features and Unification –Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs.

SEMANTIC ANALYSIS 9

Representing meaning – Semantic analysis-Lexical semantics–Word-sense disambiguation-Supervised–Dictionary based and Unsupervised Approaches- Compositional semantics-Semantic role labeling and Semantic parsing– Discourse analysis.

APPLICATIONS 9

Named entity recognition and relation extraction- IE using sequence labeling- Machine Translation (MT)- Basic issues in MT-Statistical translation-word alignment-phrase-based translation–Question Answering

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Second Edition, Prentice Hall, 2008
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly Media; First Edition, 2009
3. Roland R. Hausser, "Foundations of Computational Linguistics: Human- Computer Communication in Natural Language", Paperback, MIT Press, 2011
4. Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German", (Cognitive Technologies) Soft cover reprint,2010

Other references:

1. NLTK–Natural Language Toolkit-http://www.nltk.org/

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P15CSTE19 / PERFORMANCE EVALUATION OF COMPUTER NETWORKS

Course Outcomes (COs):
On successful completion of this course, the students should be able to

CO1: Outline the need for performance evaluation of computer system.
CO2: Apply Probability and Stochastic Processes to develop mathematical models for computer networks.
CO3: Make use of Queuing Theory, how it can be used to analyze computer networks.
CO4: Apply knowledge about Petri Nets and how it can be used to analyze the System Performance.
CO5: Summarize about the Database System Performance Analysis & Analysis of Computer Networks Components.

Pre-requisite courses: P15CST203-Network Engineering and Management

Hrs

INTRODUCTION **9**

Need for performance evaluation – Role of performance evaluation – performance evaluation Methods – Performance Metrics and Evaluation Criteria – CPU and I/O Architectures – Distributed and Network Architectures– Secondary Storage – Topologies – Computer Architecture - Fundamental Concepts and Performance Measures.

PROBABILITY AND STOCHASTIC PROCESSES **9**

Scheduling Algorithms – Workloads – Random Variables – Probability Distributions – Densities – Expectation – Stochastic Processes – Poisson Process – Birth-Death Process – Markov Process.

QUEUING THEORY **9**

Queuing Systems – Networks of Queues - Estimating Parameters and Distributions – Computational Methods – Simulation Process – Time Control – Systems and Modeling

PETRI NETS AND SYSTEM PERFORMANCE **9**

Petri Nets – Classical Petri Nets – Timed Petri Nets – Priority-based Petri Nets – Colored Petri Nets – Generalized Petri Nets – Tool Selection – Validation of Results – Performance Metrics – Evaluation – Multiple Server Computer System Analysis

PERFORMANCE ANALYSIS DATABASE SYSTEMS AND COMPUTER NETWORKS COMPONENTS **9**

Test bed systems - database systems - test bed performance analysis testing.
Simulation Modelling of Local Area Networks.

Theory: 45 Hrs **Tutorial: 0 Hr** **Total Hours: 45**

References:

1. Paul J. Fortier, Howard E. Michael, "Computer Systems Performance Evaluation and Prediction", Elsevier Science (USA), 2003.
2. Thomas G. Robertazzi, "Computer Networks and Systems: Queueing theory and Performance Evaluation", Third Edition, Springer, 2006.
3. Domenico Ferrari, "Giuseppe Serazzi", Alexandro Zeijher, Measurement & Tuning of Computer Systems –Prentice Hall Inc,1983. (Digitized 20 Nov 2007)
4. Michael F.Mories and Paul F.Roth,. "Tools and techniques, Computer Performance Evaluation", Van Nostrand, New York, 1982

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P15CSIN03 / ETHICAL HACKING

Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1 : Explain testing and issues in test plans

CO2: Explain social engineering and host reconnaissance.

CO3: Explain hacking and attacks

Pre-requisite courses: P15CST203-Network Engineering and Management

	Hrs
Introduction to Penetration Testing .NET Framework	**2**
Legal and Ethical Considerations Creating and Implementing a Test Plan	**3**
Social Engineering	**3**
Host Reconnaissance	**2**
Hacking & Attacks: Session Hijacking, Web server Attacks, Database Attacks, Password Cracking, Network Devices & Attacks, Wireless Network Attacks	**3**

Theory: 15 Hrs **Tutorial: 0 Hr** **Total Hours: 15**

P15CSIN04 / LINUX SYSTEM ADMINISTRATION

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Course Outcomes (COs):

On successful completion of this course, the students should be able to

CO1: Explain Linux concepts

CO2: Explain administration and configuration

CO3: Explain configuration of different servers

Pre-requisite courses: Nil

	Hrs
Introduction In linux - Getting Started with Linux- Browsing the File system- Running Commands and Getting Help	**2**
Standard I/O and Pipes- vi and vim -Finding and Processing Files	**2**
Managing Users, Groups, and Permissions Investigating and Managing Processes Performing User Administration	**4**
Performing Network Configuration Configuring Network Resource Access Controls Organizing Networked Systems Configuring Network File Sharing Services	**3**
Configuring a Web Server Configuring a Proxy Server Configuring a DHCP Server Configuring a NFS Server Configuring a SAMBA Server	**4**

Theory: 15 Hrs **Tutorial: 0 Hr** **Total Hours: 15**