M.E. (Computer Science and Engineering)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the M. E. Computer Science and Engineering will be able to

I. Demonstrate an exceptional involvement and active participation in their professional careers including entrepreneurship using the knowledge in Computer Science and Engineering

II. Contribute successfully as a team member/leader using common tools and adopt latest technologies in education and solve real world problems

III. Pursue life-long learning and research in specific fields of Computer Science and Engineering and develop innovative and research oriented methodologies in an effective manner.

PROGRAMME OUTCOMES (POs)

Post Graduate student of Computer Science and Engineering programme will be able to

a. Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b. Identify, analyze, formulate and solve engineering problems.
c. Design a system component and process to meet desired needs with realistic constraints such as economical, environmental, social, ethical and sustainable in the field of Computer Science and Engineering.
d. Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e. Use the techniques, skills and modern Engineering tools necessary for Engineering practice.
f. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
g. Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
h. Understand and commit to professional ethics and responsibilities and norms of engineering practice.
i. Communicate effectively on complex engineering activities with the engineering community and society, such as, being able to comprehend, write effective reports, design documentation and make effective presentations with clear instructions.
j. Demonstrate the knowledge, understanding of management and business practices with risk management and its limitations.
k. Recognize the need for ability to engage in independent and life-long learning.

MAPPING OF PEOs AND POs

PEO(s)	Programme Outcome (s)										
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
I	x	x	x								
II	x	x	x	x	x	x		x		x	
III	x			x	x		x		x		x

ME Computer Science and Engineering (Full Time)

Minimum credits to be earned: 77

First Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CS11	Discrete Mathematics and Automata Theory*	I, II	b, d	3	2	0	4
15CS12	Advanced Data Structures and Algorithms	II,III	a,b,d,e	3	0	0	3
15CS13	Advanced Operating Systems	I,II	a,c,d,e,h	3	2	0	4
15CS14	Compiler Construction and Optimization	I,II	a,b,d,e	3	2	0	4
15CS15	Object Oriented Software Engineering	I,II	a,b,c,e,j	3	0	0	3
	Elective I			3	0	0	3
15CS17	Data Structures and Algorithms Laboratory	I,II	a,b,d,e	0	0	4	2
15CS18	Operating Systems and Compiler Laboratory	I,II	a,d,e,h	0	0	4	2
15GE19	Business English - I$^{\alpha}$	II	i,j	1	0	2	2
			Total	**19**	**6**	**10**	**27**
Second Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CS21	Research Methodology	III	a,b,k	3	0	0	3
15CS22	Advanced Database Technology	I,III	a,c,d,e,k	3	2	0	4
15CS23	Mobile and Pervasive Computing	II,III	a,b,c,e	3	0	0	3
15CS24	Cloud Computing	III	a,b,e	3	0	0	3
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15CS27	Database Technology Laboratory	I,II	a,b,d,e	0	0	4	2
15CS28	Technical Seminar	III	i	0	0	2	1
15GE29	Business English - II$^{\alpha}$	II	i,j	1	0	0	1
			Total	**19**	**2**	**6**	**23**
Third Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15CS34	Project Work - Phase I	II,III	e,i				6
			Total	**9**	**0**	**0**	**15**
Fourth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CS41	Project Work - Phase II	II,III	e,i				12
			Total				**12**

* Common to Embedded Systems and Computer Science & Engineering

$^{\alpha}$ Common to all M.E. / M.Tech. Programmes

M.E. Computer Science and Engineering (Part Time)

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
First Semester							
15CS11	Discrete Mathematics and Automata Theory†	I, II	b, d	3	2	0	4
15CS12	Advanced Data Structures and Algorithms	II,III	a,b,d,e	3	0	0	3
15CS13	Advanced Operating Systems	I,II	a,c,d,e,h	3	2	0	4
15CS17	Data Structures and Algorithms Laboratory	I,II	a,b,d,e	0	0	4	2
15GE19	Business English - I$^{\alpha}$	II	i,j	1	0	2	2
			Total	**10**	**4**	**6**	**15**
Second Semester							
15CS21	Research Methodology	III	a,b,k	3	0	0	3
15CS22	Advanced Database Technology	I,III	a,c,d,e,k	3	2	0	4
15CS23	Mobile and Pervasive Computing	II,III	a,b,c,e	3	0	0	3
15CS27	Database Technology Laboratory	I,II	a,b,d,e	0	0	4	2
15GE29	Business English II$^{\alpha}$	II	i,j	1	0	0	1
			Total	**10**	**2**	**4**	**13**
Third Semester							
15CS14	Compiler Construction and Optimization	I,II	a,b,d,e	3	2	0	4
15CS15	Object Oriented Software Engineering	I,II	a,b,c,e,j	3	0	0	3
15CS24	Cloud Computing	III	a,b,e	3	0	0	3
15CS18	Operating Systems and Compiler Laboratory	I,II	a,d,e,h	0	0	4	2
			Total	**9**	**2**	**4**	**12**
Fourth Semester							
	Elective I			3	0	0	3
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15CS28	Technical Seminar	III	i	0	0	2	1
			Total	**9**	**0**	**2**	**10**
Fifth Semester							
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15CS34	Project Work - Phase I	II,III	e,i				6
			Total	**9**	**0**	**0**	**15**
Sixth Semester							
15CS41	Project Work - Phase II	II,III	e,i				**12**
			Total				**12**

† Common to Embedded Systems and Computer Science & Engineering

$^{\alpha}$ Common to all M.E. / M.Tech. Programmes

List of Core Electives							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CS51	Agent Based Intelligent Systems	I,II	a,b,e,h,k	3	0	0	3
15CS52	Data Warehousing and Data Mining	I,II	a,b,c,e	3	0	0	3
15CS53	Soft Computing	I,II	a,b,d	3	0	0	3
15CS54	Pattern Recognition	I,II	a,c,e	3	0	0	3
15CS55	Natural Language Processing	I,II	a,g,h	3	0	0	3
15CS56	Semantic Web	I,II	a,d,e	3	0	0	3
15CS57	Digital Imaging	I,II	a,b,c,e	3	0	0	3
15CS58	Big Data Analytics	I,II	a,b,d,e	3	0	0	3
15CS59	Security in Computing	II,III	a,b,e	3	0	0	3
15CS60	Advanced Communication Networks	I,III	a,b,c,d,k	3	0	0	3
15CS61	Ad-Hoc and Sensor Networks	I	a,b,c	3	0	0	3
15CS62	Network Engineering and Management	II,III	a,c,e	3	0	0	3
15CS63	High Performance Computing	II,III	a,c,e	3	0	0	3
15CS64	Advanced Computer Architecture	I,II	a,b,d,g	3	0	0	3
15CS65	Performance Evaluation of Computer Systems	I,II	a,b,d	3	0	0	3
15CS66	Software Quality Assurance	II	a,b,e,j	3	0	0	3
15CS67	Design Patterns	I,III	a,b,c,k	3	0	0	3
15CS68	Human Computer Interaction	I,II	a,e,f	3	0	0	3
15CS69	XML and Web Services	I,III	a,c,e,i	3	0	0	3
15CS70	Free and Open Source Software	I,II	a,d,e	3	0	0	3
15CS71	Internet and Web Technology	I,III	a,b,k	3	0	0	3
15CS72	Internet of Things	I,II	a,d,j	3	0	0	3
One Credit Courses (Minimum 2 Electives)							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CSXA	Matlab for Researchers	III	e	1	0	0	1
15CSXB	Android OS	III	e	1	0	0	1
15CSXC	Internet Marketing	III	e	1	0	0	1
15CSXD	Open Source Database	III	e	1	0	0	1

15CS11/15ES11 DISCRETE MATHEMATICS AND AUTOMATA THEORY
(Common to Embedded Systems and Computer Science & Engineering)

3 2 0 4

Course Objectives

- To understand and use the terms cardinality, finite and countably infinite and determine which of these characteristics is associated with a given set.
- To construct simple mathematical proofs and posses the ability to verify them.
- To solve counting problems involving the multiplication rule, permutations and combinations.
- To present some of the often encountered discrete and automata theory models and their applications
- To introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields.

Course Outcomes (COs)

1. Check the validity of the arguments.
2. Understand how to construct correct mathematical arguments.
3. Check whether a particular combination of words is a valid sentence or not
4. To apply the abstract concepts of graph theory in modeling and solving non-trivial problems in different fields of study.

Unit I

Fundamental Structures

Set theory - Relationships between sets - Operations on sets - Set identities - Principle of inclusion and exclusion - Minsets. Relations: – Binary relations - Partial orderings - Equivalence relations. Functions: – Properties of functions - Composition of functions – Inverse functions - Permutation functions.

9 Hours

Unit II

Logic

Propositional logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect – Proof by contradiction – Mathematical Induction.

9 Hours

Unit III

Combinatorics

Basics of counting – Counting arguments – Pigeonhole principle - Permutations and Combinations - Recursion and Recurrence relations – Generating functions.

9 Hours

Unit IV

Modeling Computation and Languages

Finite state machines – Deterministic and Non- deterministic finite state machines –Equivalence of DFA and NFA - Formal Languages – Classes of Grammars – Type-0 – Context Sensitive – Context Free – Regular Grammars.

9 Hours

Unit V

Graph Theory

Introduction to Graphs- Graphs operations-Graph and Matrices-Graph Isomorphism- Connected Graphs- Euler Graphs- Hamilton paths and circuits-Shortest path problem.

9 Hours

Unit VI[$]

Algebraic laws for Regular Languages- Pumping Lemma and Applications- Properties of Regular Languages- Parse trees and Language Pushdown Automaton.

Total: 45 +30 Hours

Reference(s):

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.
2. Trembly J.P. and Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill Publications Co. Ltd., New Delhi 2008..
3. Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt. Ltd. Delhi. 2010.
4. Ralph P Girmaldi and B.V. Ramana, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Fifth Edition, Pearson Education Asia, Delhi, 2007.
5. J.E. Hopcroft, R. Motwani and J.D. Ullman, *Introduction to Automata Theory, Languages and Computations* , Second Edition, Pearson Education, 2003.
6. Jonathan L Gross Jay Yellen, *Graph Theory and its Applications*, Second Edition, Taylor & Francis Group, 2006.

15CS12 ADVANCED DATA STRUCTURES AND ALGORITHMS

3 0 0 3

Course Objectives

- To understand the techniques for analyzing the complexity of algorithms
- To learn the concepts of advanced data structures
- To design algorithms for problem solving with appropriate data structures

Course Outcomes (COs)

1. Analyze the complexity of algorithms
2. Design and analyze the complexity of heap structures
3. Implement and perform complexity analysis on search tree structures
4. Solve problems using the greedy and divide and conquer methods
5. Develop skills to design and analyze the algorithms using dynamic programming and backtracking methods.

Unit I

Algorithm Analysis

Asymptotic notations – Properties of Big-oh notation – Conditional asymptotic notation – Algorithm analysis – Amortized analysis – Running time calculations -NP completeness – Recurrence equations – Substitution method for solving recurrences- Recurrence tree method for solving recurrences –Master theorem for solving recurrences.

8 Hours

Unit II

Heap Structures and Amortized Analysis

Binary heap-Basic heap operations-Min/Max heaps – d-heaps – Leftist heaps – Leftist heap property-Leftist heap operations-Binomial queues-Binomial queue structure-Binomial queue operations-implementation of binomial queues- Skew heaps -Fibonacci heaps – Cutting nodes in leftist heaps-Lazy merging for binomial queues – Amortized analysis on lazy binomial heaps-Fibonacci heap operations.

10 Hours

Unit III

Search Structures

Binary search trees – AVL trees – Single rotation-Double rotation- Splay trees – Top-down splay

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

trees-B-trees - Red-Black trees – Bottom-up insertion-Top-down red-black trees – Top-down deletion- 2-3 trees – Insertion and deletion-2-3-4 trees – Insertion and deletion- k-d trees-Hashing-Hash function-Separate chaining – Hash tables without linked lists – Rehashing.

11 Hours

Unit IV

Greedy and Divide and Conquer

Greedy method-Knapsack problem-Tree-vertex splitting –Job sequencing with deadlines – Minimum-cost spanning trees- Prim's algorithm-Kruskal's algorithm-Optimal storage on tapes – Divide-and-conquer-Merge sort-Quicksort –
Strassen's matrix multiplication –Convex hull.

8 Hours

Unit V

Dynamic Programming and Backtracking

Dynamic programming- Multistage graphs – All pairs shortest paths- Single-source shortest paths- 0/1 knapsack – Flow shop scheduling – Backtracking - 8-queens problem – Sum of subsets- Graph coloring – Hamiltonian cycles - Knapsack problem

8 Hours

Unit VI[$]

Treaps - AA trees - k-d trees

Total: 45 Hours

Reference(s)

1. Mark Allen Weiss, *Data Structures and Algorithms in C++*, Fourth Edition, Pearson, 2014.
2. E. Horowitz, S. Sahni and S. Rajasekaran, *Computer Algorithms / C++*,University Press, 2008
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, *Introduction to Algorithms*, Third Edition, Prentice Hall of India, New Delhi, 2012
4. Adam Drozdek, *Data Structures and Algorithms in C++*, Fourth Edition, 2013.

15CS13 ADVANCED OPERATING SYSTEMS

3 2 0 4

Course Objectives

- To know the components of the operating systems.
- To understand the concept of process management, storage management, Input Output and file systems.
- To cognize perception of distributed operating systems concepts.

Course Outcomes (COs)

1. Analyze the requirements of operating system and demonstrate the scheduling mechanisms.
2. Implement the algorithm for memory management techniques.
3. Understand the needs of distributed operating system.
4. Analyze the resource management strategies.
5. Classify the distributed file models.

Unit I

Process Management

Operating system and services - Process structure and PCB - Threads – Inter process communication – CPU scheduling approaches - Process synchronization-The Critical-section problem-Peterson's solution-Synchronization hardware-Mutex locks-Semaphores –Monitors-Deadlocks.

11 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Memory Management and File Management

Memory management- Paging- Segmentation-Virtual memory- Demand paging – Page replacement algorithms- File systems – Access methods – Directory structure and implementation– File System structure and implementation – Allocation methods.

9 Hours

Unit III

Distributed Operating System

Introduction-Remote procedure call – Logical clocks – Vector clocks – Distributed mutual exclusion – Non token based algorithms – Token based algorithms– Deadlock detection algorithms – Election algorithms -Byzantine agreement problem-Load distributing algorithms – Performance comparison.

9 Hours

Unit IV

Distributed Resource Management

Distributed file systems – Architecture-Design issues-Distributed shared memory-Architecture-Algorithms distributed shared memory models- Distributed shared memory synchronization-consistency-Memory coherence – Coherence protocols - Design issues.

8 Hours

Unit V

Distributed File Systems

Introduction, good features of DFS- File models- File accessing models- File sharing semantics-File-Caching schemes- File replication- Fault tolerance- Atomic transactions and design principles.

8 Hours

Unit VI[$]

Multimedia Operating Systems

Introduction to multimedia-Multimedia process scheduling-Multimedia file system paradigms-Disk scheduling for multimedia

Total: 45+30 Hours

Reference(s)

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating System Concepts. New Delhi: Addison Wesley Publishing Company, 2012
2. MukeshSinghal, and NiranjanShivratri, Distributed operating system. New Delhi: TMH, 2001
3. William Stallings, Operating Systems Internals and Design Principles. New Delhi: Pearson Education, 2011.
4. Naji, Linux OS. New Delhi: Prentice Hall of India, 2003
5. C.M. Krishna, Kang G. Shin, Real-Time Systems, McGraw-Hill International Editions, 1997

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS14 COMPILER CONSTRUCTION AND OPTIMIZATION

3 2 0 4

Course Objectives

- To enhance the fundamental concepts of various phases of compiler and its uses
- To learn finite state machines, parsers and intermediate code generation
- To enrich the knowledge in code optimization and code generation

Course Outcomes (COs)

1. Understand the structure of a compiler with its phases
2. Specify regular expressions for matching tokens in a language and show the equivalence between regular expressions, NFAs, and DFAs
3. Describe the parsing methods that are used in compilers
4. Depict Intermediate representations and intermediate code generation
5. Apply code optimization techniques and explicate the concept of code generation

Unit I
Introduction to Compiler

Language processors - Structure of a compiler – Grouping of phases into passes – Compiler construction tools - Science of building a compiler: Modeling in compiler design and implementation – Science of code optimization Applications of compiler technology: Implementation of high-level programming languages – Optimization for compiler architecture-Design of new computer architecture – Software productivity tools

7 Hours

Unit II
Lexical Analysis

Role of the lexical analyzer - Input buffering - Specification and recognition of tokens- The lexical-analyzer generator Lex- Finite automata - Regular expression to finite automation - Design of a lexical-analyzer generator-Optimization of DFA-Based pattern matchers

11 Hours

Unit III
Syntax Analysis

Role of a parser - Context-free grammars – Writing a grammar - Top-down parsing – Bottom-up parsing : Reductions-Handle pruning- Shift-reduce parsing – Conflicts during shift –reduce parsing - LR parsers : Simple LR– Canonical LR – LALR – Parser generators : YACC

11 Hours

Unit IV
Intermediate Code Generation

Variants of syntax trees - Three-Address Code - Types and declarations: Operations within expressions – Incremental translation - Translation of expressions - Type checking - Control flow : Boolean expression – Short-circuit code – Flow-of-control statements-Control-flow translation of Boolean expressions – Back patching – Switch statements

8 Hours

Unit V
Code Optimization & Code Generation

Principal sources of optimization - Introduction to data flow analysis - Issues in the design of a code generator - Target language – Addresses in the target code - Basic blocks and flow graphs - Simple code generator - Peephole optimization - Register allocation and assignment

8 Hours

Unit VI[$]

Optimizing for parallelism and locality – Basic concepts – Matrix multiply : An example

Total: 45+30 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman *Compilers: Principles, Techniques and Tools* , Pearson, 2014.
2. Keith D Cooper and Linda Torczon, *Engineering a Compiler*, Elsevier Science, 2011
3. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, *Modern Compiler Design*, Wiley, 2008
4. Kennath C. Louden, *Compiler Construction Principles and Practice*. New Delhi: Vikas publishing House, 2003.
5. Randy Allen, Ken Kennady, *Optimizing Compiler for Modern Architectures : A Dependence based Approach*, Morgan Kaufmann Publishers, 2002

15CS15 OBJECT ORIENTED SOFTWARE ENGINEERING

3 0 0 3

Course Objectives

- To learn the basic concepts of software engineering
- To understand the usage of UML diagrams
- To design and test software project

Course Outcomes (COs)

1. Understand the concepts of various UML diagrams
2. Illustrate the software project using effective requirement analysis
3. Describe the object oriented design concepts
4. Test and manage the software project using object oriented software engineering
5. Analyze the configuration management and project management activities

Unit I

Introduction to Object Oriented Software Engineering

Software engineering concepts -Software engineering development activities - Managing software development - Introduction to UML- Modeling concepts – UML diagrams - Project organizations - Project communication concepts- Organizational activities

9 Hours

Unit II

Requirements Elicitation and Analysis

An overview of requirements elicitation – Requirements elicitation concepts - Requirements elicitation activities - Managing requirements elicitation - Analysis overview – Concepts of analysis - Activities: from use cases to objects- Managing analysis.

9 Hours

Unit III

System Design and Object Design

Decomposing the system- An overview of system design - System design concepts - System design activities - From objects to subsystems - Addressing design goals - Managing system design - Object design - Reusing pattern solutions - Reuse concepts - Solution objects – Inheritance - Design patterns - Reuse activities - Managing reuse.

9 Hours

Unit IV

Testing and Managing Changes

Testing concepts - Testing activities - Component inspection- Managing testing - Rationale management - Rationale concepts - Rationale activities - From issues to decisions - Managing rationale heuristics for communicating about rationale - Issue modeling and negotiation - Conflict resolution strategies.

9 Hours

Unit V

Configuration Management and Project Management

Configuration management concepts - Configuration management activities -Managing

configuration management - Project management - Project management concepts - Classical project management activities - Agile project management activities.

9 Hours

Unit VI[$]

On drawing tools - Iterative Planning and Project Issues – Iterative Development and Understanding Planning.

Total: 45 Hours

Reference(s)

1. Bernd Bruegge, Allen H., *Object-Oriented Software Engineering: Using UML, Patterns and Java*, Pearson Education, 2011
2. Timothy C. Lethbridge and Robert Laganiere, *Object -Oriented Software Engineering: Practical software development using UML and Java*, McGraw-Hill Higher Education 2013
3. Sommerville, *Software Engineering*, Pearson Education,2009
4. Roger S. *Pressman*. *Software Engineering - A Practitionar's Approach*, McGraw-Hill International Edition, 2010

15CS17 DATA STRUCTURES AND ALGORITHMS LABORATORY

0 0 4 2

Course Objectives

- To implement the different data structures in C++
- To introduce mathematical aspects and implement solutions for specific problem.
- To implement the different algorithmic design techniques.

Course Outcomes (COs)

1. Identify appropriate data structures for solving computing problems

List of Experiments

1. Construct a binary search tree and perform various tree traversals
2. Create Min Heap and perform the operations on it
3. Implement operations on Leftist Heap
4. Implement merging of two Skew Heaps
5. Perform rotations on AVL Tree
6. Implement sorting techniques
7. Create convex hull using divide and conquer
8. Job sequencing with deadlines using greedy method
9. 0/1 Knapsack using dynamic programming
10. Graph coloring using backtracking
    Mini Project

Total: 60 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS18 OPERATING SYSTEMS AND COMPILER LABORATORY

0 0 4 2

Course Objectives(COs)

- Implementation of scheduling Algorithms & Memory Management Techniques
- Perform lexical analysis and use lexical analyzer generators
- Perform parsing and intermediate representation

Course Outcomes(COs)

1. Demonstrate the concepts of operating system
2. Demonstrate the importance of implementing parser.
3. Design of applications for generating intermediate code.

List of Experiments

Operating Systems

1. Write a program for CPU Scheduling Algorithms
   - First Come First Serve
   - Shortest Job First Serve
   - Priority scheduling
   - Round Robin scheduling
2. Write a program for Best fit, First Fit Algorithm for Memory Management.
3. Write a program for Memory Allocation with Pages.
4. Write a program to implement Banker's algorithm.
5. Write a program for Deadlock Handling operations.
   Mini Project

Compiler

1. Construction of NFA for a regular expression.
2. Write a program for Shift reduce parser.
3. Write a program for predictive parser.
4. Generation of intermediate code.
5. Write a program for lexical analyzer using LEX tool.
   Mini Project

Total: 60 Hours

15GE19 BUSINESS ENGLISH I

1 0 2 2

Course Objectives

- To acquire skills for using English in workplace effectively.
- To communicate for essential business needs.
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA).

Course Outcomes(COs)

1. To enable students to get International recognition for work and study.
2. To use English confidently in the International business environments.
3. To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations.

UNIT I

GRAMMAR AND VOCABULARY

Comparison of adjectives – forming questions – asking complex questions – expressing purpose and function – tenses – conditionals – time statements – modal verbs – active and passive voice – articles – direct and indirect speech – cause and effect – relative pronouns – expressions followed by – *ing* forms – countable / uncountable – acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers.

10 Hours

UNIT II
LISTENING
Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening– distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

7 Hours

UNIT III
SPEAKING
Word and sentence stress – clear individual sounds – turn taking – initiating and responding - intonation patterns – pronunciation – mother tongue intrusion– conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately.

10 Hours

UNIT IV
READING
Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts– spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distractor – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading - transcoding.

8 Hours

UNIT V
WRITING
Paragraphing a text – using appropriate connectives – editing practice –Longer Documents: writing a proposal.

10 Hours
Total: 45 Hours

15CS21 RESEARCH METHODOLOGY

3 0 0 3

Course Objectives
- To understand some basic concepts of engineering research and its methodologies.
- To identify various sources of information for literature review and data collection.
- To families the various procedures to formulate appropriate research problem and design of experiments.

Course Outcomes (COs)
The students will be able to
1. Know the types of research and data collection methods.
2. Identify the different sampling methods.
3. Recognize the concepts of hypothesis testing.
4. Acquire knowledge about measurements and data analysis
5. Understand the report writing

Unit I
Introduction
Definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps.
Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

9 Hours

Unit II

Sampling Methods

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

9 Hours

Unit III

Hypotheses Testing

Testing of hypotheses concerning means -one mean and difference between two means -one tailed and two tailed tests, concerning variance – one tailed Chi-square test.

9 Hours

Unit IV

Measurement and Data Analysis

Concept of Measurement-Problems in measurement in research-Validity and Reliability- Levels of measurement-Nominal, Ordinal, Interval, Ratio- Data Preparation- Univariate analysis (frequency tables, bar chart, pie charts, percentages), Bivariate analysis- Cross tabulation.

10 Hours

Unit V

Report Writing

Report writing- Types of report, guidelines to review report, typing instructions, oral presentation- Layout of research paper-Ethical issues related to publishing, plagiarism and Self plagiarism.

8 Hours

Unit VI[$]

Use of Encyclopedias, Research guides, Handbooks etc., Academic Databases for Computer Science Discipline.

Total: 45 Hours

Reference(s)

1. Kothari, C.R., *Research Methodology –Methods and techniques*, New Age Publications, New Delhi, 2009.
2. Donald Cooper, Pamela Schindler, *Business Research Methods*, Mc-Graw Hill Higher Education, 12th Edition,2010.
3. Panneerselvam, R., *Research Methodology*, Prentice-Hall of India, New Delhi, 2004.

15CS22 ADVANCED DATABASE TECHNOLOGY

3 2 0 4

Course Objectives

- To learn the data models and to conceptualize a database system using ER diagrams.
- To know the concepts of parallel and distributed databases.
- To gain knowledge about the emerging database technologies.

Course Outcomes (COs)

1. Understand the basic database system concepts.
2. Design parallel and distributed databases.
3. Apply the object oriented concepts in databases.
4. Implement the active, temporal and deductive databases.
5. Know the mobile database concepts.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I

Database System Concepts

File systems - Database systems - Database architecture - Data models: Relational model - Entity-relationship model: Constraints - Removing redundant attributes in entity sets- Entity-relationship diagrams - Reduction to relational schemas - Entity-relationship design issue- Extended E-R features - Alternative notations for modeling - Data normalization and database design: First normal form, second normal form, third normal form- Boyce codd normal form.

10 Hours

Unit II

Parallel and Distributed Databases

Parallel databases: I/O parallelism – Inter and intra query parallelism – Inter and intra operation parallelism – Distributed database concepts - Distributed data storage – Distributed transactions – Commit protocols – Concurrency control – Distributed query processing

7 Hours

Unit III

Object and Object Relational Databases

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.

8 Hours

Unit IV

Enhanced Data Models

Active database concepts and triggers – Temporal databases – Spatial databases – Multimedia databases– Deductive databases – XML databases: XML data model – DTD - XML schema - XML querying - Geographic information systems-Genome data management.

11 Hours

Unit V

Emerging Technologies

Mobile Database system- Location and handoff management – Effect of mobility on data management – Location dependent data distribution –Execution Model based on ACID Transaction Framework-Pre-write transaction execution model-Mobile transaction models - Concurrency control - Information retrieval.

9 Hours

Unit VI[$]

Advanced application development– Advanced transaction processing- PostgreSQL

Total: 45 + 30 Hours

Reference(s)

1. R. Elmasri, and S. B. Navathe, *Fundamentals of Database Systems*. New Delhi: Pearson Education/Addison Wesley, 2015.
2. Henry F. Korth, Abraham Silberschatz, and S. Sudharshan, *Database System Concepts*. New Delhi: McGraw Hill, 2010.
3. Vijay Kumar, *Mobile Database Systems* Wiley Series on Parallel and Distributed Computing, USA, Wiley-Interscience, 2006.
4. Thomas Cannolly and Carolyn Begg, *Database Systems, A Practical Approach to Design, Implementation and Management*. New Delhi: Pearson Education, 2014.
5. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*. New Delhi: McGraw Hill, 2007.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS23 MOBILE AND PERVASIVE COMPUTING

3 0 0 3

Course Objectives

- To understand the fundamental concepts of mobile computing
- To acquire knowledge on mobile technologies and networking
- To know the essentials of pervasive computing

Course Outcomes (COs)

1. Know the basics of mobile computing with its security and standards
2. Explicate the emerging mobile technologies
3. Describe the concept of WLAN and mobile network
4. Identify the fundamentals of pervasive computing
5. Elucidate the applications and operating systems of pervasive computing

Unit I

Introduction to Mobile Computing

Mobility of bits and bytes – Wireless the beginning – Mobile computing- Dialogue control- Networks – Middleware and gateways- Application and services- Developing mobile computing applications- Security- Standards- Players in wireless space- Architecture for mobile computing- Three tier architecture.

8 Hours

Unit II

Mobile Technologies

Emerging technologies: Bluetooth-Radio frequency identification- Wireless broadband-Mobile IP-Internet protocol version 6- Short message Service: Mobile computing over SMS-Short message services- General packet radio services: Packet data network- Architecture-Operations-Data services-Application for GPRS-Limitations of GPRS.

11 Hours

Unit III

Mobile Networking

Wireless LAN advantage-Standards-Architecture-Mobility-Deploying-Mobile Ad Hoc networks and sensor networks-Security- Wi-Fi verses 3G-Internet networks and interworking: Fundamentals of call processing – Intelligence in the networks-SS #7 signaling-In conceptual model-Soft switch-Programmable networks.

9 Hours

Unit IV

Introduction to Pervasive Computing

Introduction to pervasive computing: Scenarios–Roaming environment-Pervasive computing infrastructure-Personalized services – Pervasive computing market- M-business- Applications examples-Hardware - Human - Machine interfaces biometrics and operating systems.

8 Hours

Unit V

Pervasive Computing Application

Device connectivity – Protocols, security and device management – World wide web application architecture – Transcoding –Client authentication via internet- Voice technology: Speech application–Personal digital assistants: Device- Operating systems-Characteristics-Software components-Standards-Mobile applications.

9 Hours

Unit VI[$]

IP Multimedia Subsystem – Mobile VoIP – Application to voice access - Example

Total: 45 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. Asoke K Talukder and Poopa R Yavagal, *Mobile Computing*,Tata McGraw-Hill,2013.
2. Jochen Buekhardt, Horst Henn, Stefan Hepper, Klaus Rintdorff and Thomas Schack, *Pervasive Computing: Technology and architecture of mobile internet applications*, Pearson Education,2010.
3. Reza B Fat and Roy T Fielding, *Mobile Computing Principles*, Cambridge University Press, 2010.
4. Hansmann Uwe, Merk Lothar and Nicklous Mart, *Pervasive Computing: The Mobile World*, Springer Professional, 2011.
5. Chimay J, Anumba and Xiangyu Wang, *Mobile and Pervasive Computing*, Springer Professional, 2012.

15CS24 CLOUD COMPUTING

3 0 0 3

Course Objectives

- To understand the key elements of cloud platform
- To know intelligent cloud services and infrastructure
- To impart knowledge in applications of cloud computing

Course Outcomes (COs)

1. Identify the systems and mechanisms to support cloud computing.
2. Acquire the knowledge of virtualization to create shared resource pool environment.
3. Know the different types of cloud web services.
4. Understand cloud computing infrastructure.
5. Describe different types of applications common use in the cloud.

Unit I
Introduction

Defining cloud computing –Cloud types –Characteristic of computing– benefits and disadvantage of cloud computing-Accessing the role of open standards –Measuring the cloud value – Exploring the cloud computing Stack-Connecting to the cloud – Understanding services and applications by type.

10 Hours

Unit II
Understanding Abstraction and Virtualization

Using virtualization technique – Load balancing and virtualization- Understanding hypervisors – Undemanding machine imaging- Porting applications – Capacity planning – Baseline and metrics – Network capacity – Scaling – Exploring platform as service.

7 Hours

Unit III
Cloud Computing Web Services

Google Web service – Surveying the Google application portfolio – Google toolkit – Amazon web services – Components and services – EC2- Storage systems – Database services- Microsoft cloud services – Windows azure platform – Windows live.

11 Hours

Unit IV
Cloud Infrastructure

Managing the cloud – Understanding cloud security – Understanding service oriented architecture: Introducing service oriented architecture- Defining SOA communications - Managing and monitoring SOA - SOA and cloud computing.

8 Hours

Unit V
Cloud Applications and Mobile Cloud

Moving applications to the cloud: Applications in the cloud-Applications and cloud APIs-

Communicating with the cloud – Instant messaging – Collaboration technologies –Social networks – Media and streaming -Working with mobile devices: Defining the mobile market – Smartphone with the cloud.

9 Hours

Unit VI[$]
Mobile web service: Service types - Service discovery-Wireless application protocol and other protocols -Synchronization

Total: 45 Hours

Reference(s)

1. Barrie Sosinsky, *Cloud Computing Bible*, Wiley Publishing, Inc,.2011
2. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S , *Mastering in Cloud Computing*, McGraw Hill Education (India) Private Limited, 2013
3. Michael Miller,*Cloud Computing*, Pearson Education, New Delhi, 2012
4. Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2010
5. Fern Halper, Marcia Kaufman, Bloor Robin and Judith Hurwit, Cloud Computing for Dummies, Wiley India, 2009.

15CS27 DATABASE TECHNOLOGY LABORATORY

0 0 4 2

Course Objectives

- To study and implement the basic SQL commands.
- To implement the database design in PL/SQL.
- To implement PL/SQL programs and database connectivity.

Course Outcomes (COs)

1. Understand the basic SQL commands.
2. Develop procedures, functions in SQL.
3. Develop packages in SQL.

List of Experiments

1. Working basic SQL commands (DDL, DML, DCL, and TCL).
2. Executing Single Row and Group functions.
3. Running SQL queries on Join and Integrity constraints.
4. Implementation of Synonyms, Sequences, Views and Indexes.
5. Design a database using first and second normal form.
6. Perform the Locks & Partitions operations.
7. Simple programs using PL/SQL blocks.
8. Apply the concepts of Exception handling in PL/SQL block.
9. Create Cursors and Triggers.
10. Use the concept of Procedures and Function in PL/SQL block.
11. Use the concept of package in PL/SQL block
12. Develop a banking system to maintain its customer details using PL/SQL programming. Mini Project

Total: 60 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15GE29 BUSINESS ENGLIS II

1 0 0 1

Course Objective

- To acquire skills for using English in business environment .
- To communicate appropriately in business contexts.
- To prepare students for taking BEC Vantage level examination conducted by the Cambridge English Language Assessment (CELA).

Course Outcome (COs)

1. To enable students to acquire business terms for communication.
2. To use English confidently in the business contexts.
3. To be able to take part in business discussion and write formal and informal business correspondences.

UNIT I

Speaking

Non-verbal communication – agreeing / disagreeing, reaching decisions, giving and supporting opinions – making mini presentations – extending on conservations – collaborative task – tongue twisters.

6 Hours

UNIT II

Writing

Business letters – fax – Shorter Documents: e-mail - memo – message - note – report writing – formal / informal styles.

9 Hours

Total: 15 Hours

Reference(s):

1. Guy Brook-Hart, "BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.

15CS51 AGENT BASED INTELLIGENT SYSTEMS

3 0 0 3

Course Objectives

- To introduce the fundamental concepts of artificial intelligence
- To explore the different paradigms in knowledge representation and reasoning
- To recognize problems to solve using artificial intelligence and machine learning

Course Outcomes (COs)

1. Understand the history, development and various applications of artificial intelligence
2. Learn the knowledge representation and reasoning techniques in logic programming
3. Familiarize with constructing plans in planning agents.
4. Analysis the concept in presence of uncertainty.
5. Apply and integrate various artificial intelligence techniques in intelligent system development

Unit I

Introduction

Definitions - Foundations - History - Intelligent agents: Nature of environment-Structure of agents-problem solving-Searching: uninformed search strategies-Searching with partial information – Heuristics: Local search algorithms – Constraint satisfaction problems: Backtracking search - Game playing: Optimal decisions-Alpha, Beta pruning.

9 Hours

Unit II

Knowledge Representation and Reasoning

Logical Agents: Propositional logic-Reasoning patterns in propositional logic-Agent based propositional logic-First order logic: Syntax and semantics-First order inference: Unification-Chaining- Resolution strategies-Knowledge representation: Objects-Actions-Events

9 Hours

UnitIII

Planning Agents

Planning problem: State space search-Partial order planning-Graphs-Hierarchical network planning-Nondeterministic domains-Conditional planning-Execution monitoring and replanning-Continuous planning-Multi agent planning.

9 Hours

Unit IV

Agents and Uncertainty

Acting under uncertainty – Probability notation-Bayes rule and use –Probabilistic reasoning: Bayesian networks-Other approaches-Time and uncertainty: Temporal models-Simple decisions: Utility theory - Decision network – Complex decisions: Value iteration-Policy iteration.

9 Hours

Unit V

Higher Level Agents

Knowledge in learning: Explanation based learning-Relevance information-Statistical learning methods: Instance based learning-Neural network-Reinforcement learning: Passive and active communication: Formal grammar- Augmented grammars-Future of AI.

9 Hours

Unit VI[$]

Probabilistic language processing - Perception-Robotics.

Total: 45 Hours

Reference(s)

1. Stuart Russell and Peter Norvig, *Artificial Intelligence - A Modern Approach*, Prentice Hall India, 2012.
2. Elaine Rich, Kevin Knight and Shivashankar B Nair, *Artificial Intelligence*, Tata McGraw Hill, 2010.
3. M. Tim Jones, *Artificial Intelligence: A Systems Approach*, Jones and Bartlett Publisher, 2010.
4. Winston, Patrick Henry, *Artificial Intelligence*, Addison Wesley, 2008.

15CS52 DATA WAREHOUSING AND DATA MINING

3 0 0 3

Course Objectives

- To introduce the basic concepts and techniques of data mining
- To develop the skills using recent data mining software for solving practical problems.
- To assess the strengths and weaknesses of various methods and algorithms

Course Outcomes (COs)

1. Understand the basic concepts of Data Mining.
2. Apply preprocessing techniques in Data mining.
3. Identify Association Rules using algorithms.
4. Explain classification, prediction and clustering.
5. Know the fundamental concepts of Data warehouse.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I
Introduction

Data mining – Knowledge discovery in database – Architecture of data mining - Kinds of data and patterns – Technologies in data mining –Applications: Business intelligence – Web search engines – Major issues in data mining: Mining methodology – User interaction – Efficiency and scalability – Diversity of database types – Data mining and society.

7 Hours

Unit II
Knowing the data and data preprocessing

Data objects and attribute types – Basic statistical descriptions of data – Data visualization - Measuring data similarity and dissimilarity - Data preprocessing - Data cleaning – Data integration – Data reduction – Data transformation and Discretization.

10 Hours

Unit III
Mining frequent patterns, associations and correlations

Association rules mining: Basic concepts – Frequent item set mining methods – Pattern evaluation methods – FROM association analysis to correlation analysis – Comparison of pattern evaluation measures – Pattern mining - Pattern mining in multilevel, multidimensional space – Constraint based frequent pattern mining.

10 Hours

Unit IV
Classification and Clustering

Classification: Basic concepts -Decision tree induction- Bayes classification methods - Rule based classification – Model evaluation and selection – Techniques to improve classification accuracy - Clusters analysis: Partitioning methods – Hierarchical methods.

10 Hours

Unit V
Data Warehousing

Data warehouse: Basic concepts data warehouse modeling: Data cube and OLAP – Data cube – schemas for multidimensional data models – Dimensions – Measures – OLAP operations - Data warehouse design and usage – Data warehouse implementation.

8 Hours

Unit VI[$]
Data Mining Applications

Data mining in science and engineering – Data mining for intrusion detection and prevention, Ubiquitous and invisible data mining – Privacy, security and social impacts of data mining.

Total: 45 Hours

Reference(s)

1. Jiawei Han and Micheline Kamber, Jian Pei, *Data Mining Concepts and Techniques*. Noida: Elsevier, 2013.
2. Alex Berson and Stephen J Smith, *Data Warehousing, Data Mining and OLAP (Data Warehousing/Data Management)*. New Delhi: Tata Mcgraw- Hill, 2004
3. Usama M. Fayyad, Gregory Piatetsky-Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, *Advances in Knowledge Discovery and Data Mining*. New Delhi: The M.I.T Press, 1996.
4. Ralph Kimball, *The Data Warehouse Life Cycle Toolkit*. New Delhi: John Wiley & Sons Inc., 1998.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS53 SOFT COMPUTING

3 0 0 3

Course Objectives

- To recognize the feasibility of applying a soft computing methodology for a particular problem
- To gain knowledge in Neural networks
- To understand the fuzzy sets, fuzzy logic and optimization technique

Course Outcomes (COs)

1. Acquire knowledge in the fundamentals of Neuro-Fuzzy and Fuzzy sets
2. Describe the Fuzzy Inference Systems and Optimization
3. Understand the concepts of Neural Networks
4. Explain the basic principles of Neuro-Fuzzy Modeling
5. Know the fundamentals of genetic algorithm

Unit I

Introduction to Neuro-Fuzzy, Fuzzy sets

Introduction - Soft computing constituents and conventional Artificial intelligence – Neuro-Fuzzy and soft computing characteristics. Fuzzy sets: Definitions – Set-theoretic Operations. Fuzzy Rules, Reasoning: Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules.

9 Hours

Unit II

Fuzzy Inference Systems and Optimization

Fuzzy inference systems: Mamdani fuzzy models – Sugeno fuzzy models – Tsukamoto fuzzy models – Input Space partitioning and Fuzzy modeling. Derivative-based optimization: Descent methods –Method of steepest descent – Newton's methods – Step size determination. derivative - Free optimization: Simulated annealing – Random search.

10 Hours

Unit III

Neural Networks

Adaptive networks – Back propagation for feed forward networks – Batch Learning - Pattern by pattern Learning. Supervised learning neural networks: Perceptrons – Adaline - Radial basis function networks. Unsupervised learning neural networks: Competitive learning network – Kohonen self organising networks – Learning vector quantization - Hebbian learning.

10 Hours

Unit IV

Neuro-Fuzzy Modeling

Adaptive neuro-fuzzy Inference systems: Introduction – ANFIS architecture - Hybrid learning algorithm. Classification and regression trees: Decision trees – CART algorithm for tree induction. Data clustering algorithms: K-means clustering – Fuzzy C-means clustering – Mountain clustering – Subtractive clustering.

8 Hours

Unit V

Genetic Algorithm

Fundamentals of genetic algorithm – History – Basic concepts – Creation of off springs – Working principal – Encoding – Fitness function – Reproduction. Genetic modelling: Inheritance operators – Cross over – Inversion and Deletion – Mutation operator – Bitwise operators - Generational cycle – Convergence of genetic algorithm.

8 Hours

Unit VI[$]

Hybrid Soft Computing Techniques

Hybrid systems –Neuro fuzzy hybrids – Neuro genetic hybrids - Fuzzy genetic hybrids.

Total: 45 Hours

Reference(s)

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun and EijiMizutani, *Neuro-Fuzzy and Soft Computing: AComputational Approach to Learning and Machine Intelligence*, New Delhi: Prentice-Hall of India, 2010.
2. S.Rajasekaran and G.A.V.Pai, *Neural Networks, Fuzzy Logic And Genetic Algorithms*, PHI, 2003.
3. David E. Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning*, Singapore:Addison Wesley, 2001.
4. S.N.Sivanandan and S.N. Deepa, *Principles of Soft Computing*, Wiley India, 2007. ISBN: 10: 81-265 -1075-7.

15CS54 PATTERN RECOGNITION

3 0 0 3

Course Objectives

- To know the fundamental algorithms for pattern recognition
- To instigate the various classification techniques
- To originate the various structural pattern recognition and feature extraction techniques

Course Outcomes (COs)

1. Understand and apply various algorithms for pattern recognition
2. Familiar with the clustering concepts and algorithms
3. To know the structural pattern recognition and feature extraction techniques
4. Understand the feature selection and extraction
5. Understand neural network in pattern recognition

Unit I

Pattern Classifier

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation -Maximum likelihood estimation - Bayesian parameter estimation - Perception algorithm - LMSE algorithm - Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

9 Hours

Unit II

Unsupervised Classification

Discrete and Binary classification – Techniques to directly obtain linear classifiers - Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

9 Hours

Unit III

Structural Pattern Recognition

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV
Feature Extraction and Selection
Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation - Binary feature selection.

9 Hours

Unit V
Recent Advances
Neural network structures for pattern recognition - Neural network based pattern associators – Unsupervised learning in neural pattern recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers –Pattern classification using Genetic Algorithms.

9 Hours

Unit VI[$]
Multilayer, Feed forward Network Structure – Delta Rule – Generalized data rule.

Total: 45 Hours

Reference(s)
1. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

15CS55 NATURAL LANGUAGE PROCESSING

3 0 0 3

Course Objectives
- To provide an introduction to the central issues of Natural Language Processing (NLP) in relation to linguistics and statistics.
- To understand the fundamentals of parsing and semantics.
- To recognize the methods used for question answering and summarization techniques.

Course Outcomes (COs)
1. Attain fundamental knowledge in natural language processing.
2. Describe the methods for morphological analysis.
3. Familiarize with techniques used for speech recognition.
4. Acquire knowledge on linguistic information using parsing techniques.
5. Gain comprehensive knowledge in question answering and summarization techniques.

Unit I
Introduction
Knowledge in speech and language processing – Ambiguity – Models and algorithms – Language, Thought and understanding – History of NLP.

7 Hours

Unit II
Words
Regular expressions and automata – Words and transducers: Finite-state transducers – FSTs for morphological parsing - Human morphological processing– N- Grams– Word classes and part of speech tagging: Part-of-speech tagging –Hidden markov model - Maximum entropy models.

10 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III
Speech
Phonetics: Speech sounds and phonetic transcription – Articulatory phonetics– Speech synthesis: Text normalization– Phonetic analysis – Prosodic analysis – Automatic speech recognition: Speech recognition architecture – Applying the hidden markov model to speech – Computational phonology: Syllabification – Learning phonology and morphology.

10 Hours

Unit IV
Syntax, Semantics and Pragmatics
Formal grammars of english: Grammar rules – Tree banks - Parsing with context-free grammars: Dynamic programming parsing methods– Statistical parsing – Features and unification: Feature structures – Unification of feature structures – Computational semantics: Syntax driven semantic analysis – Lexical semantics: Word net-Primitive decomposition-Metaphor.

11 Hours

Unit V
Applications
Question answering and summarization: Information retrieval – Factoid question answering – Summarization – Multi-document Summarization – Summarization evaluation.

7 Hours

Unit VI[$]
Dialogue and Conversational Agents
Properties of human conversations – Basic dialogue systems – Voice XML – Dialogue system design and evaluation.

Total: 45 Hours

Reference(s)
1. Daniel Jurafsky and James H. martin, *Speech and Language Processing*, Second Edition, Pearson Higher Education, 2009.
2. Daniel Bikel and ImedZitouni, *Multilingual Natural Language Processing Applications: From Theory to Practice*, IBM Press, 2012.
3. David A. Grossman and OphirFedier, *Information Retrieval: Algorithms and Heuristics (The Information Retrieval Series)*, Springer, 2004.
4. Michael W Berry, *Survey of Text mining I: Clustering, Classification and Retrieval*, Copyrighted material, Springer, 2013.

15CS56 SEMANTIC WEB

3 0 0 3

Course Objectives
- To understand the importance of Resource Description Framework in semantic web
- To study the scope of ontology for semantic web
- To know the applications of semantic web

Course Outcomes (COs)
1. Understand the basics of semantics web and XML
2. Know the significance of RDF and basics of SPARQL
3. Construct an ontology for semantic web
4. Identify the logic and inference rules
5. Explain the applications of semantic web technologies

Unit I
Introduction
Semantic web vision: History – Semantic web layers –Semantic web technologies – Semantics in

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

semantic web – XML: Structuring –Namespaces – Addressing and querying XML documents – Processing XML documents.

9 Hours

Unit II

RDF and Querying the Semantic Web

RDF data model-Syntaxes-Adding semantics-RDF schema-RDF and RDF schema in RDF schema-An axiomatic semantics for RDF and RDF schema-Querying the semantic web-SPARQL-Basics-Filters-Constructs-Organizing result sets-Querying schemas.

10 Hours

Unit III

Ontology

Introduction – Ontology movement – OWL – OWL specification - OWL elements – OWL constructs: Simple and complex – Ontology engineering: Introduction – Constructing ontologies – Reusing ontologies – On-to-knowledge semantic web architecture

9 Hours

Unit IV

Logic and Inference

Logic – Description logics - Rules – Monotonic rules: Syntax, semantics and examples – Non-monotonic rules – Motivation, syntax, and examples – Rule markup in XML: Monotonic rules - Non-monotonic rules

9 Hours

Unit V

Applications of Semantic Web Technologies

Good relations-British Broadcasting Corporation (BBC) artists-BBC world cup 2010 website-Government data, Newyork times-Sigma and sindice-Open Calais-Schema.org-Future of semantic web

8 Hours

Unit VI[$]

Web data exchange and syndication – Semantic wikis – Semantic portals- Semantic metadata in data formats- RIF applications

Total: 45 Hours

Reference(s)

1. 1.Grigorous Antoniou and Van Hermelen, *A Semantic Web Primer*. New Delhi: The MIT Press,2012.
2. James Hendler, Henry Lieberman and Wolfgang Wahlster, *Spinning the Semantic*
3. *Web: Bringing the world wide web to its full potential*. New Delhi: The MIT Press, 2005.
4. Shelley Powers, *Practical RDF*. Mumbai: O'reilly publishers, 2009
5. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, *Foundations of Semantic Web Technologies*, Chapman & Hall/CRC, 2009

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS57 DIGITAL IMAGING

3 0 0 3

Course Objectives

- To understand the fundamentals of image processing
- To know about the image enhancement and restoration techniques
- To recognize the techniques in image representation and description

Course Outcomes (COs)

1. Understand the fundamentals and transforms of a digital image
2. Identify the different techniques in image enhancement
3. Recognize the various filters in image restoration
4. Analyze the coding techniques in image compression
5. Understand the image segmentation and representation methods

Unit I

Digital Image Fundamentals and Transforms

Fundamentals steps in digital image processing- Elements of visual perception – Image sampling and quantization Basic relationship between pixels – An introduction to the mathematical tools used in digital image processing - Basic geometric transformations-Introduction to fourier transform and discrete fourier transform

8 Hours

Unit II

Image Enhancement Techniques

Basic intensity transformation functions–Histogram processing: Histogram equalization, Histogram specification Fundamentals of spatial filtering: The mechanics of spatial filtering, correlation and convolution- Smoothing spatial filters- Sharpening spatial filters

9 Hours

Unit III

Image Restoration

Model of image degradation/restoration process – Noise models – Restoration in the presence of noise only spatial filtering - Estimating the degradation function-Inverse filtering –Minimum mean square error filtering –Constrained least squares filtering – Geometric mean filter

7 Hours

Unit IV

Image Compression

Fundamentals of image compression-Huffman coding- Golomb coding -Arithmetic coding -LZW coding- Run length coding-Symbol-based coding- Bit-Plane coding-Block transform coding-Predictive coding-Wavelet coding - Digital image watermarking

10 Hours

Unit V

Image Segmentation and Representation

Edge detection – Thresholding - Region based segmentation – Boundary representation: Chain codes- Polygonal approximation using MPP – Boundary segments – Boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors-Relational descriptors

11 Hours

Unit VI[$]

FFT methods for digital image re-sampling: optimality, fast algorithms and application examples

Total: 45 Hours

Reference(s)

1. Rafael C Gonzalez, Richard E Woods, *Digital Image Processing* – Third edition Pearson Education 2011.
2. A.K. Jain *Fundamentals of Digital Image Processing* , PHI, New Delhi 2009

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

3.William K Pratt, *Digital Image Processing*, John Willey 2007.
4.Chanda Dutta Magundar *Digital Image Processing and Application*, Prentice Hall of India, 2006.

15CS58 BIG DATA ANALYTICS

3 0 0 3

Course Objectives

- To understand the fundamental concepts of Big data analytics
- To learn to analyze the big data using machine learning techniques.
- To apply the hadoop tools and Map Reduce Concepts.

Course Outcomes (COs)

1. Work with big data platform.
2. Understand the machine learning algorithms for mining large volumes of data.
3. Analyze the Hadoop and Map Reduce framework associated with big data.
4. Understand the fundamentals of Hadoop Clusters.
5. Develop Big Data applications Using Pig and Hive.

Unit I
Introduction to Big Data

Introduction to big data platform – Challenges of conventional systems - Intelligent data analysis – Nature of data - Analytic processes and tools - Analysis vs reporting - Modern data analytic tools - Statistical concepts: Sampling distributions - Re-sampling.

9 Hours

Unit II
Mining Data Streams

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.

8 Hours

Unit III
Hadoop

History of hadoop -The hadoop distributed file system –Hadoop I/O- Developing a map reduce application-How map reduce works - Map reduce types and formats- Map reduce features.

11 Hours

Unit IV
Hadoop Environment

Setting up a hadoop cluster - Cluster specification - Cluster setup and installation – Hadoop configuration-Security in hadoop - Administering hadoop – HDFS – Monitoring maintenance-Hadoop benchmarks- Hadoop in the cloud.

9 Hours

Unit V
Frameworks

Applications on big data using pig and hive – Data processing operators in pig – Hive services – HiveQL – Querying data in hive - Fundamentals of HBase and zookeeper- Zookeeper services-Production.

8 Hours

Unit VI[$]
Hadoop Tools

Avro – Avro map reduce -Flume- Sink groups – Sqoop – Sqoop connectors.

Total: 45 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer, 2013.
2. Anand Rajaraman and Jeffrey David Ullman, *Mining of Massive Datasets*, Cambridge University Press, 2014.
3. Tom White *Hadoop: The Definitive Guide*, O'reilly Media, 2012.
4. Bill Franks, *Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics*, John Wiley & sons, 2012.
5. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, McGrawHill Publishing, 2012.

15CS59 SECURITY IN COMPUTING

3 0 0 3

Course Objectives

- To learn the vulnerabilities and threats in the computing systems
- To understand the cryptography based approaches in security
- To know the implementation and use of security mechanisms

Course Outcomes (COs)

1. Apply cryptographic algorithms for encryption and decryption for secure data transmission.
2. Identify the threats against networked applications.
3. Analyze the security problems in database systems and data mining.
4. Exemplify the protection features of an operating system.
5. Understand the legal, copyright and privacy issues.

Unit I

Security Issues in Computing

Introduction to computer security – Computer criminals – Methods of defense – Cryptography – Terminology and background - Making encryption algorithms– Data encryption standard: Background and history- Overview of DES algorithm- Fundamentals concepts of DES- Double and triple DES.

9 Hours

Unit II

Program Security and Network Security

Secure programs- Non malicious program errors- Threats in networks- Network security controls- Firewalls: Types-Design of firewall- Personal firewall- Comparison of firewall types.

9 Hours

Unit III

Database Security and Data Mining Security

Introduction to databases - Security requirements – Reliability and integrity – Sensitive data – Inference: Direct attack and indirect attack – Multilevel database– Data mining- Privacy and sensitivity – Data correctness and integrity – Availability of data.

9 Hours

Unit IV

Design and Protection of Operating System

Protected objects and methods of protection- Memory and address protection- Control of access to general objects-User authentication- Trusted system – Security policies – Models of security- Trusted operating system design.

9 Hours

Unit V

Legal Issues in Computer Security

Protecting programs and data – Information and the law – Rights of employees and employers – Computer crime-Administering security- Security planning – Risk analysis – Organizational security policies.

9 Hours

Unit VI[$]

Cyber security- AES encryption algorithm- Viruses and targeted malicious code

Total 45 Hours

Reference(s)

1. Charles B.fleeger and Shari Lawrence Pfleeger, *Security in Computing*, Fifth Edition, 2015, Pearson Education.
2. William Stallings, *Cryptography and Network Security: Principles and Practice*, Prentice Hall of India/Pearson Education, New Delhi, Fifth edition,2011.
3. Dieter Gollmann, *Computer Security*, John Wiley & Sons Ltd., 2011.
4. Douglas R.Stinson, *Cryptography Theory and Practice*, CRC, 2006.

15CS60 ADVANCED COMMUNICATION NETWORKS

3 0 0 3

Course Objectives

- To understand the wired, wireless LANs and backbone networks
- To gain in-depth knowledge about the routing protocols
- To interpret congestion control and traffic management

Course Outcomes (COs)

1. Identify and understand the requirements to choose the appropriate network structure for real time issues.
2. Analyze the functionalities and modes of operation of protocols in the network architecture.
3. Understand the process of flow control mechanisms to fulfill networking requirements in wired and wireless technology.
4. Describe the concept of high speed networking and to create optimal systems.
5. Acquire knowledge of protocols for routing of information across the network

Unit I

Review of Networking Concepts:

Traffic characterization and quality of service, network services, high-performance networks,– Implementing network software –Layered architecture, Open data network model, performance - Reliable transmission – Ethernet and multiple access network (802.3) – Wireless - 802.11/Wi-Fi - bluetooth/802.15.1 - Cell phone technologies

9 Hours

Unit II

Internetworking and End to End Protocol

Switching and bridging – Datagrams - Virtual circuit switching - Source routing - Bridges and LAN switches – Basic internetworking (IP) - Service model - Global addresses - Datagram forwarding in IP - Subnetting and classless addressing - Address translation - Host configuration - Error reporting - Virtual networks and tunnels – Simple demultiplexer (UDP) -Reliable byte stream (TCP) – Remote procedure call (RPC).

8 Hours

Unit III

Congestion and Traffic Management

Effects of congestion – Traffic management – Congestion control in packet - Switching networks – Frame relay congestion control – Need for flow and error control – Link control mechanisms – ARQ performance – TCP flow and congestion control - Traffic control.

10 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

ATM Network

ATM network, features, addressing, signaling, routing, ATM header structure, ATM adaptation layer (AAL), management and control, BISDN, internetworking with ATM. Optical networks, WDM systems, cross connects, optical LAN, optical paths and networks.

10 Hours

Unit V

Internet Routing

Overview of graph theory and Least - cost paths – Interior routing protocols – Internet routing principles – Distance vector and link state protocol – Exterior routing protocols: BGP and IDRP multicasting.

8 Hours

Unit VI[$]

Advanced Networks Concepts

VPN – Remote - Access VPN, site - to - site VPN, tunneling to PPP, security in VPN.MPLS - Operation, routing, tunneling and use of FEC.

Total: 45 Hours

Reference(s)

1. Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, Morgan Kaufmann, 2012.
2. William Stallings, *High - Speed Networks and Internets: Performance and Quality of Service*, Pearson Education, 2010.
3. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson Education, 2011.
4. Behrouz Forouzan, *Data communications and Networking*, Tata Mc Graw Hill Education, 2009.
5. James F. Kurose and Keith W. Ross, *Computer Networking: A Top - Down Approach*, Pearson Education, 2013.

15CS61 AD-HOC AND SENSOR NETWORKS

3 0 0 3

Course Objectives

- Learn about the issues in the design of wireless ad hoc networks
- Understand the working of protocols in different layers of mobile ad hoc and sensor networks
- Understand security issues in ad hoc and sensor networks.

Course Outcomes (COs)

1. Explain the concepts, network architectures ad hoc and wireless networks
2. Understand and analyze routing protocols for ad hoc with respect to protocol design issues
3. Know the concepts, applications and MAC protocols in wireless sensor network.
4. Recognize design challenges with communication protocols and localization protocols in WSN.
5. Understand various security practices and protocols of Ad-hoc and Sensor Networks

Unit I

Ad Hoc Wireless Networks and MAC

Fundamentals of WLAN's – IEEE 802.11 architecture - Self configuration and auto configuration -Issues in ad-Hoc wireless networks – MAC protocols for Ad-Hoc wireless networks – Contention based protocols - TCP over ad-hoc networks-TCP protocol overview - TCP and MANET's – Solutions for TCP over ad-hoc networks

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Adhoc Routing Protocols and Management

Routing in ad-hoc networks- Introduction -Topology based versus position based approaches - Proactive, reactive, hybrid routing approach - Principles and issues – Location services - DREAM – Quorums based location service – Grid forwarding strategies – Greedy packet forwarding – Restricted directional flooding- Hierarchical routing- Other routing protocols.

10 Hours

Unit III

Wireless Sensor Networks Fundamentals and MAC

Introduction –WSN applications-Factors influencing WSN design-MAC challenges- Protocols-Contention based- S-MAC-B-MAC-CC-MAC- Other contention based MAC protocols-Reservation based mechanism-TRAMA-Other reservation based mechanism-Hybrid mechanism-Zebra-MAC.

9 Hours

Unit IV

WSN Routing Protocols and Localization

Challenges for routing- Data-centric and Flat-architecture protocols- Flooding- Gossiping-Sensor SPIN - Directed diffusion-Hierarchical protocols: LEACH - PEGASIS - TEEN and APTEEN-Geographical routing protocols- QoS-based protocols-Localization in WSN- Ranging techniques-Range-Based localization protocols- Range-free localization protocols

9 Hours

Unit V

AdHoc and Sensor Network Security

Security in ad-hoc and sensor networks – Key distribution and management – Software based anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure ad-hoc routing protocols – Sensor network security protocols - SPINS

8 Hours

Unit VI[$]

Integrating MANETs, WLANs and cellular networks – Heterogeneous architecture – Mobile user stations

Total: 45 Hours

Reference(s)

1. C.Siva Ram Murthy and B.S.Manoj, *Ad Hoc Wireless Networks – Architectures and Protocols*, Pearson Education, 2011
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, *Ad-Hoc and Sensor Networks: Theory and Applications*, Second Edition, World Scientific Publishing, 2011.
3. Ian F. Akyildiz, Mehmet Can Vuran , *Wireless Sensor Network*, John Wiley & Sons,2010.
4. Erdal Çayırcı , Chunming Rong, *Security in Wireless Ad Hoc and Sensor Networks*, John Wiley and Sons,
   2009
5. Waltenegus Dargie, Christian Poellabauer, *Fundamentals of Wireless Sensor Networks Theory and Practice*, John Wiley and Sons, 2010

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS62 NETWORK ENGINEERING AND MANAGEMENT

3 0 0 3

Course Objectives

- To understand the concepts of computer networks and to study the functions of different layers. To analyze the different protocols and network components.
- To understand the implementation of network management protocol.

Course Outcomes (COs)

1. Analyze the requirements of modern communication network.
2. Exemplify the process of network management.
3. Explain the network management protocol model and its versions.
4. Describe procedure remote monitoring and telecommunication network management.
5. Understand the broadband network and its services.

Unit I

Foundations of Networking

Data communication networks – Protocols and standards –OSI model – Layers in OSI –TCP/IP protocol suite – Error detection and correction – Flow control – Error control

8 Hours

Unit II

Data link Layer and Network layer

SONET architecture –Layers – Frames – STS multiplexing –SONET networks – Frame relay-ATM-ATM LAN – AAL- IPv4 Address – IPv6 address –Internetworking – Transition from IPv4 to IPv6 –Address mapping – ICMP– IGMP – ICMPv6 –Congestion control

10 Hours

Unit III

SNMPv1, SNMPv2 and SNMPv3

SNMPv1 Communication model-Functional model-SNMPv2 system architecture-Structure of management information-Management information base -SNMP v2 protocol -Compatibility with SNMPv1-SNMPv3 key features-Documentation architecture-Applications-MIB-Security-Interoperability.

9 Hours

Unit IV

RMON and Telecommunication Network Management

Remote monitoring - RMON SMI and MIB - RMON1 - RMON2- Remote monitoring - TMN - TMN conceptual model -TMN architecture - TMN management service architecture – TMN integrated view

9 Hours

Unit V

Broadband Network Management

Broadband networks and services, ATM Technology-VP,VC, ATM Packet, Integrated service, ATMLAN emulation, virtual LAN. ATM network management-ATM network reference model, integrated local management Interface. ATM management information base, Role of SNMD and ILMI in ATM

9 Hours

Unit VI[$]

Configuration management, Fault management, Performance management.

Total 45 Hours

Reference(s)

1. Behrouz A. Forouzan, *Data Communication and Networking.* New Delhi: Tata McGraw Hill, 2010
2. Mani Subramanium , *Network Management Principles and practices*. New Delhi:

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Pearson Education,2010
3. Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*. Noida: Morgan Kaufman Publishers, 2012.
4. William Stallings, *SNMP, SNMPv2, SNMPv3 and RMON1 and RMON2*. New Delhi: Pearson Education,2002

15CS63 HIGH PERFORMANCE COMPUTING

3 0 0 3

Course Objectives

- To learn the need and working of modern high performance processors
- To understand the techniques to achieve parallelism
- To identify the techniques used to design algorithm for parallel environment

Course Outcomes (COs)

1. Understand the basic working principle of modern multi-core processors.
2. Exemplify the techniques to access data in shared environment for process running parallel.
3. Analyze the factors that help in achieving parallelism.
4. Apply algorithm design techniques to design algorithm for parallel computing
5. Understand the algorithms for sorting and Graph.

Unit I

Modern Processors

Stored-program computer architecture - General-purpose cache-based microprocessor architecture - Memory hierarchies - Multicore processors -Multithread processors - Vector processors - Basic optimization techniques for serial code - Common sense optimizations - Simple measures - large impact - Role of compilers.

9 Hours

Unit II

Optimization and Parallel Computers

Data access optimization - Balance analysis and light speed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems - Networks - Basics of parallelization – Parallelism - Parallel scalability.

10 Hours

Unit III

Introduction to Parallel Computing

Motivating parallelism - Scope of parallel computing - Parallel programming platforms: Implicit parallelism trends in microprocessor architectures - Limitations - Dichotomy -Physical organizations - Communication costs - Routing mechanisms for interconnected networks.

8 Hours

Unit IV

Principles of Parallel Algorithm Design

Preliminaries - Decomposition techniques – Recursive, Data, Exploratory, Speculative and Hybrid decomposition - Characteristics of tasks and interactions -Mapping techniques for load balancing - Methods for containing interaction overheads –Parallel algorithm models.

9 Hours

Unit V

Sorting and Graph Algorithms

Issues in sorting on parallel computing - Sorting networks – Bubble sorts and its variants - Quick sort - Graph algorithms - Definition and representation – Prim’s algorithm - Dijkstra's algorithm - All pairs shortest path - Transitive closure - Connected components.

9 Hours

Unit VI[$]

Parallel programming – Message passing interface – Using openmp – Posix threads – The role of interconnect

Total 45 Hours

Reference(s)

1. Georg Hager and Gerhard Wellein, *Introduction to High Performance Computing for Scientists and Engineers*, Chapman & Hall, 2010.
2. Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, *Introduction to parallel computing*, Second edition, Addison-Wesley 2009.
3. John Levesque and Gene Wagenbreth, *High Performance Computing: Programming and Applications*, Chapman & Hall, 2010.
4. John L. Hennessy and David Patterson, *Computer Architecture-A Quantitative Approach*, Elsevier, 2012.

15CS64 ADVANCED COMPUTER ARCHITECHTURE

3 0 0 3

Course Objectives

- To introduce the fundamental techniques based on parallel processing.
- To develop the foundations for analyzing the benefits of design options in computer architecture.
- To gain knowledge about the application of the various computing techniques.

Course Outcomes (COs)

1. Analyze the working principle of ILP.
2. Understand the concepts of multithreading in ILP.
3. Familiarize with the different multiprocessor architecture.
4. Explore the use of cache optimizations and virtual memory.
5. Identify the different storage systems.

Unit I

Pipelining and ILP

Fundamentals of computer design - Measuring and reporting performance - Instruction level parallelism and its exploitation - Concepts and challenges –Basic compiler techniques for ILP-Reducing branch costs with prediction-Overcoming data hazards with dynamic scheduling – Dynamic branch prediction.

9 Hours

Unit II

Advanced Techniques for Exploiting ILP

Speculation-Multiple issue processors-Compiler techniques for exposing ILP - Limitations on ILP for realizable processors - Hardware versus software speculation-Multithreading: Using ILP support to exploit thread-level parallelism -Performance of advanced multiple issue processors-Efficiency in advanced multiple issue processors.

9 Hours

Unit III

Multiprocessors

A taxonomy of parallel architectures- Models for communication and memory architecture - Symmetric and distributed shared memory architectures – Cache coherence issues - Performance issues –Synchronization issues – Models of memory consistency - Interconnection networks – Buses, crossbar-Multi-stage switches.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

Memory Hierarchy

Introduction – Eleven advanced Optimizations of cache performance - Memory technology and optimizations – SRAM technology-DRAM technology-Protection: Virtual memory and virtual machines-Protection via virtual memory-Protection via virtual machine-Virtual machine monitor-Design of memory hierarchies.

9 Hours

Unit V

Storage Systems

Advanced topics in disk storage -Disk power-Advanced topics in disk arrays-Definition and examples of real faults and failures- I/O performance, reliability measures and benchmarks-Throughput versus response time-Transaction processing benchmarks-A Little queuing theory.

9 Hours

Unit VI[$]

CMP architecture - SMT architecture - Graphics processing unit architecture.

Total: 45 Hours

Reference(s)

1. John L. Hennessey and David A. Patterson, *Computer Architecture – A quantitative approach*. Noida: Morgan Kaufmann / Elsevier, 2012.
2. William Stallings, *Computer Organization and Architecture – Designing for Performance*. New Delhi: Pearson Education, 2008.
3. David E. Culler and Jaswinder Pal Singh, *Parallel Computing Architecture: A hardware/ software approach*. Noida: Morgan Kaufmann / Elsevier, 1999.

15CS65 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS

3 0 0 3

Course Objectives

- To understand the mathematical foundations and metrics needed for performance evaluation of computer systems.
- To develop new queueing analysis for both simple and complex systems.
- To make the students to use of smart scheduling techniques and introduce the analytical techniques for evaluating scheduling policies.

Course Outcomes (COs)

1. Explain the need for performance evaluation and its metrics.
2. Use discrete-time and continuous-time Markov chains to model real world systems.
3. Explain the Multi-Server and Multi-Queue systems.
4. Describe the Real-World Workloads with case study.
5. Develop analytical techniques for evaluating scheduling policies.

Unit I

Overview Of Performance Evaluation

Need for performance evaluation in computer systems – Overview of performance evaluation methods – Introduction to queueing – Probability review – Generating random variables for simulation – Sample paths, convergence and averages – Little's law – Modification for closed systems.

9 Hours

Unit II

Markov Chains and Simple Queues

Discrete-time markov chains – Ergodicity theory – Real world examples – Google, Aloha –

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Transition to continuous-time markov chain – M/M/1 and PASTA.

9 Hours

Unit III

Multi-server and Multi-queue Systems

Server farms: M/M/K and M/M/K/K – Capacity provisioning for server farms – Time reversibility and Burke's theorem – Networks of queues and Jackson product form – Classed and closed networks of queues.

9 Hours

Unit IV

Real-world Workloads

Case study of real-world workloads – Phase-type distributions and Matrix - Analytic methods – Networks with time- sharing servers – M/G/1 queue and the inspection paradox – Task assignment policies for server farms.

9 Hours

Unit V

Smart Scheduling in the M/G/1

Performance metrics – Scheduling non-preemptive and preemptive non-size-based policies - Scheduling non- preemptive and preemptive size-based policies – Scheduling - SRPT and fairness.

9 Hours

Unit VI[$]

System performance evaluation – Tool selection and use – Validation of results – Performance metrics – Evaluation.

Total: 45 Hours

Reference(s)

1. Mor Harchol - Balter, *Performance Modeling and Design of Computer Systems– Queueing Theory in Action*, Cambridge University Press, 2013.
2. Raj Jain, *The Art ofComputer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling*, Wiley-Interscience, 2008.
3. Lieven Eeckhout, *Computer Architecture Performance Evaluation Methods*, Morgan and Claypool Publishers, 2010.
4. Paul J. Fortier and Howard E. Michel, *Computer Systems Performance Evaluation and Prediction*, Elsevier, 2003.

15CS66 SOFTWARE QUALITY ASSURANCE

3 0 0 3

Course Objective (COs)

- To understand software quality assurance activities with tools and techniques.
- To know the standards and components of software quality assurance
- To study the metrics for software quality assurance

Course Outcome (COs)

1. Describe the quality management framework and related quality program concepts.
2. Explain commercial standards and the impact on quality assurance.
3. Analyze the relationship of process and product quality assurance (PPQA) to SQA.
4. Understand the quality management in information technology.
5. Exemplify Software quality metrics methodology and software quality control tools.

Unit I

Organizing Quality Management

Quality management framework - Quality program concepts – Organizational aspects of quality program – Quality program organizational relationship-Mapping quality program functions to

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

project organizational entities.

8 Hours

Unit II

Standards used in Software Quality Assurance

Software Quality Assurance (SQA) in ISO standards – SQA in IEEE standards –IEEE std 730-2002- IEEE std 829-1998- IEEE std 1028-1997-ITIL standards - ANSI/EIA standards and RTLA/DO standards

7 Hours

Unit III

Software Quality Assurance

Identifying SQA personnel needs – Characteristics of a good SQA engineer – SQA engineering staff – Pareto principle applied to SQA – Software inspections and walkthroughs – Measurements-Transition of cost to quality - Software audit – Performing the audit - Software safety and its relation to SQA – CMMI – PPQA relationship to SQA

11 Hours

Unit IV

Quality Management in IT

ITSM processes – IT best practices – ITSM standards – Process improvement models – Customer requirements – Monitoring and measuring ITSM performance - Procurement quality – IT quality professional – Cost of software quality system – CoSQ system to organization.

11 Hours

Unit V

SQA Metrics

Software quality indicators – PSM – CMMI- PSP and TSP – Six sigma - Seven quality control tools: traditional and modern tools-check sheet - Pareto diagram- Histogram - Run chart- Scatter diagram - Control chart

8 Hours

Unit VI[$]

Integrating Quality Activities in the Project Life Cycle - Reviews - Software Testing – Strategies - Software Testing –Implementation

Total: 45 Hours

Reference(s)

1. Schulmeyer G. Gordon, *Handbook of Software Quality Assurance*. London: Artech House Inc, 2008.
2. Daniel Galin, *Software Quality Assurance from theory to implementation*, Pearson Education Limited, 2009.
3. Milind Limaye. *Software Quality Assurance*, Tata McGraw-Hill Education, 2011
4. Stephen H. Kan. *Metrics and Models in Software Quality Engineering*, Addison-Wesley Professional, 2003
5. Murali Chemuturi, *Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers*, J. Ross Publishing Inc, 2011

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS67 DESIGN PATTERNS

3 0 0 3

Course Objectives

- To understand the fundamentals of design patterns
- To learn the types and features of design patterns
- To study patterns that enable the reuse of software architectures

Course Outcomes (COs)

1. Describe the way that design patterns are documented and classified.
2. Explain the way in which the creational patterns are used to create reusable patterns.
3. Use the structural patterns to compose classes and objects into larger structures.
4. Apply the behavioral pattern to manage algorithms and assign responsibilities to objects.
5. Design a Document Editor using patterns.

Unit I
Introduction

Design patterns- Design patterns in smalltalk MVC- Describing design patterns –The catalog of design patterns-Organizing the catalog- How design patterns solve design problems- How to select a design pattern- How to use a design pattern.

8 Hours

Unit II
Creational Patterns

Factory pattern- Abstract factory pattern- Builder pattern- Factory method – Prototype pattern– Singleton pattern-Summary of creational patterns.

8 Hours

Unit III
Structural Patterns

Adapter – Bridge - Composite – Decorator – Façade – Flyweight – Proxy – Summary of Structural Patterns.

9 Hours

Unit IV
Behavioral Patterns

Chain of responsibility- Command- Interpreter– Iterator – Mediator – Memento – Observer– State – Strategy -Template method–Visitor.)

11 Hours

Unit V
Document Editor – A Case Study

Design problems- Document structure- Formatting- Embellishing the user interface- Supporting multiple look-and-feel standards- Supporting multiple window systems- User operations-Spelling checking and hyphenation.

9 Hours

Unit VI[$]
Design Patterns and Java Foundation Classes

Writing a simple JFC program- Radio buttons and toolbars- Menus and actions.

Total: 45 Hours

Reference(s)

1. Dr. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, *Design Patterns: Elements of Reusable Object - Oriented Software*, Pearson Education, Inc, New Delhi, 2012.
2. James W. Cooper, *The Design Patterns Java Companions* , Addision Wesley Design Patterns Series, 2012.
3. Bruce Eckel, *Thinking in Patterns with Java* , MindView Inc, 2006.
4. Cay S. Horstmann , *Object- Oriented Design and Patterns* , John Wiley & Sons, 2005

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CS68 HUMAN COMPUTER INTERACTION

3 0 0 3

Course Objectives

- To Learn the design techniques and fundamentals of Human Computer Interaction(HCI)
- To know the various types of existing interfaces and evaluation techniques
- To understand the applications of HCI in emerging trends

Course Outcomes (COs)

1. Understand the requirements and specifications for the interaction design.
2. Describe the different types of interactions and interfaces.
3. Understand the techniques to support data analysis , interpretation and presentation
4. Analyze the evaluation techniques of human interaction
5. Determine the most appropriate HCI methods to meet the needs of a practical software development project

Unit I

Interaction Design, Conceptualizing Interaction and Cognitive Aspects

Introduction – Good and poor design – User experience – The process of interaction design – Interaction design and the user experience – Understanding the problem space and conceptualizing design – Conceptual models – Interface metaphors – Interaction types – Paradigms, theories, models and frameworks – Cognition – Cognitive frameworks.

7 Hours

Unit II

Social, Emotional Interaction and Interfaces

Introduction – Face-to-face conversations – Remote conversations – Telepresence – Co-presence – Emergent social phenomena - Emotional interaction: Introduction – Emotions and the user experience – Expressive interfaces – Frustrating interfaces - Persuasive technologies and behavioural change – Anthropomorphism and zoomorphism – Models of emotion – Interface types.

11 Hours

Unit III

Data Gathering, Analysis, Interpretation and Presentation

Introduction – Five key issues – Data recording – Interviews – Questionnaires –Observation – Choosing and combining Techniques- Qualitative and quantitative – Simple quantitative analysis – Simple qualitative analysis – Tools to support data analysis – Using theoretical frameworks.

10 Hours

Unit IV

Evaluation Framework

Goals of evaluation – Types of evaluation – Evaluation case studies – DECIDE: A framework to guide evaluation – Usability testing –Conducting experiments – Field studies – Inspections- Heuristic evaluation and walkthroughs – Analytics –Predictive models.

8 Hours

Unit V

Ubiquitous Computing, Hypertext and World Wide Web

Ubiquitous computing application research – Virtual & augmented reality –Understanding hypertext – Finding things– Web technology and issues – Static web content – Dynamic web content- Groupware systems – Computer mediated communication – DSS – Frameworks for groupware- Information and data visualization.

9 Hours

Unit VI[$]

Changes in topics of HCI research over time – Shifts in measurement in HCI – Inherent conflicts

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

in HCI – Interdisciplinary nature of HCI research.

Total: 45 Hours

Reference(s):

1. Yvonne Rogers, Helen Sharp, Jenny Preece, *Interaction Design: beyond human-computer interaction*,John-Wiley and Sons Inc., 2011.
2. Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, *Human Computer Interaction*, Pearson Education, 2008.
3. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, *Research Methods in Human-Computer Interaction*, Wiley, 2010.
4. Dov Te'eni, Jane Carey, Ping Zhang, *Human-Computer Interaction: Developing Effective Organizational Information Systems*, John-Wiley and Sons Inc., 2007.

15CS69 XML AND WEB SERVICES

3 0 0 3

Course Objectives

- To introduce the basic concepts of XML technology
- To understand the concepts of web services key technologies
- To know the ideas of XML security mechanisms

Course Outcomes (COs)

1. Understand the XML basics to develop Web application
2. Describe the various XML technologies
3. Explicate the concepts of Web Services and its Infrastructure
4. Explain the web services using SOAP
5. Acquire knowledge on UDDI, WSDL and XML security mechanis

Unit I
Introduction

Introduction to internet and WWW – Creating markup with XML: Introduction to XML markup- Parsers and well formed XML documents- Parsing an XML document with msxml- Characters- Markup- CDATA sections- XML namespace- Document Type Definition (DTD) -Schemas.

8 Hours

Unit II
XML Technology

XML path language: Introduction – Nodes - Location paths - Node set operators and functions - Extensible style sheet language transformations - Extensible style sheet language formatting objects - Xlink, XPointer, XInclude and XBase.

10 Hours

Unit III
Web Services

Evolution of distributed computing- Client/Server applications- CORBA - Java RMI – Microsoft DCOM – Introduction to web services - Building web services architecture: Web services architecture and its core building blocks – Tools of trade - Webs services communication model - Implementing web services.

8 Hours

Unit IV
SOAP

Developing web services using SOAP – Anatomy of a SOAP message - SOAP encoding - SOAP message exchange model – SOAP communication - SOAP messaging - SOAP bindings for transport protocols - SOAP security - Building SOAP web services.

10 Hours

Unit V
Description and Discovery of Web Services and Security in Web Services

Web services description language - Universal description discovery and integration (UDDI) -

Programming with UDDI - Inquiry APIs - Publishing APIs - Implementations of UDDI - Web services security: XML encryption-XML signature

9 Hours

Unit VI[$]

Introduction to J2EE-Web services using J2EE

Total: 45 Hours

Reference(s)

1. H.M.Deitel, P.J.Deitel, T.R.Nieto, T.M.Lin, *XML How to Program*, Pearson Education, 2012.
2. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, *Developing Java Web Services*, Wiley Publishing Inc., 2011.
3. Frank. P. Coyle, *XML*, Web *Services and the Data Revolution*, Addison-Wesley Professional, 2002.
4. Steve Graham and Doug Davis, *Building Web services with Java*, Pearson Education 2008.

15CS70 FREE AND OPEN SOURCE SOFTWARE

3 0 0 3

Course Objectives

- To understand the basics of open source software.
- To gain the knowledge of working with Linux platform and database.
- To be familiar with different programming concepts in Linux.

Course Outcomes (COs)

1. Understand the fundamentals of Linux operating system.
2. Describe the working of PHP programming.
3. Elucidate the concepts of file handling and database programming in PHP.
4. Analyze the basic concepts in Python.
5. Explain the programming concepts of files and error handling using Python.

Unit I

Introduction

Introduction to open sources - Need - Advantages - Application of open sources. Open source operating systems: LINUX: Introduction - General overview - Kernel mode and user mode – Process - Advanced concepts –Scheduling
– Personalities – Cloning – Signals - Development with linux.

8 Hours

Unit II

PHP

Introduction - Variables types in PHP - Understanding data types - Loose typing - Testing variable - Changing variables data type - Type casting - Operators and expressions - Operator types - Operator precedence – Constants - Decisions and loops - Strings- Arrays-Functions.

8 Hours

Unit III

File Management with PHP

Working with files and directories: Getting information on files - Opening and closing files - Reading and writing to files - Reading and writing strings of characters - Testing - Reading and writing entire files - Working with file permissions - Working with directories - Introduction to databases and SQL.

10 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

Introduction to Python

Exploring python – Creating python programs – Statements – Building blocks – Testing functions - Strings - Lists and tuples – String functions - Sets - Dictionaries – Combining dictionaries – Making copies – Zip list – Loops – Dynamic programming – Persistent variables.

9 Hours

Unit V

Python Programming

Files – Operating system commands – Errors and exceptions - Input and output - Functions – Modules – Classes: Constructors – Boundaries – Object reference – Inheritance – Types - Tests – Variables – Classes as dynamic records - – Object oriented programming.

10 Hours

Unit VI[$]

Importance of communities in open source movement - JBoss community- Developing blog, group, forum, social network for social purpose.

Total: 45 Hours

Reference(s):

1. Remy Card, *The Linux Kernel Book*, Wiley Publications, 2003
2. Timothy A Budd, *Exploring Python* , Tata McGrawHill, 2011
3. Matt Doyle, *Beginning PHP 5.3*, Wiley Publishing, 2010.

15CS71 INTERNET AND WEB TECHNOLOGY

3 0 0 3

Course Objectives

- To understand the client / server programming
- To apply web programming languages for developing web applications
- To know the unique features of scripting languages

Course Outcomes (COs)

1. Design web pages using HTML and CSS
2. Develop web pages using java script
3. Describe server side programming techniques in web technology
4. Understand the concept of JSP
5. Know the basics concept of web services

Unit I

Web Essentials

Internet – Web clients – Web servers – Markup languages – Introduction to XHTML-Editing XHTML-Headings-Linking –Tables-Images-Forms-Internal linking – Frames - Lists- Cascading Style Sheets (CSS): Features-Style rule cascading and inheritance - Text properties –CSS box model.

9 Hours

Unit II

Client Side Programming

Client side vs. Server side programming languages - Introduction to java script –Control statements I - Control statements II - Functions- Objects – Arrays – Build-in objects - DOM: History and levels- Document tree-DOM event handling-Non compliant browsers.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III
Server Side Programming
Java servlet: Architecture – Servlet life cycle -Simple programs using java servlet– Parameter data – Sessions – Cookies – Other servlet capabilities –Data storage –Servlet and concurrency- JDBC- Connecting a java servlet program to a database

9 Hours

Unit IV
Representing Web Data
XML documents and vocabularies-Versions and declarations-Namespaces-DTD and XML schema-XML parsers: DOM vs. SAX-XSLT – Xquery - XPath- Separating programming and presentation: Introduction to java server pages– JSP and servlets – Running JSP applications - Basic JSP – Java beans classes and JSP - Tag libraries and files.

9 Hours

Unit V
Web Services
Web services concepts - Writing java web services – Web services for clients – WSDL – Representing data types: XML schema – Communicating object data: SOAP related technologies – SOAP encoding of struct data-Software installation-Storing java objects as files-Databases and java Servlets

9 Hours

Unit VI[$]
INTERNET SECURITY & FIREWALLS
Security threats from mobile codes- Types of viruses - client server security threats - Data & Message security- encrypted documents and emails - Firewalls: Hardened firewall hosts - IP-Packet Screening- Proxy Application Gateways

Total: 45 Hours

Reference(s)
1. Jeffrey C Jackson, *Web Technology – A computer Science perspective*, Person Education, New Delhi, 2011.
2. Chris Bates, *Web Programming – Building Internet Applications*, Wiley India, 2013.
3. Deitel, Deitel and Neito, *INTERNET and WORLD WIDE WEB – How to program*, Pearson education, New Delhi, 2011.
4. Gopalan. N.P, *Web Technology A Developer Perspectives*, PHI, 2010.

15CS72 INTERNET OF THINGS

3 0 0 3

Course Objectives
- To understand the components and the protocols in Internet
- To learn to manage the resources in the Internet
- To deploy the resources into business

Course Outcomes (COs)
1. Identify the components of IOT
2. Program the sensors and controller as part of IOT
3. Understand how to manage resources in IOT
4. Develop a business Model for IOT
5. Understand conversion from IOT to web of things

Unit I
Introduction
Definition – Phases – Foundations – Policy– Challenges and issues - Identification - Security –

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Privacy. Components in internet of things: Control units – Sensors – Communication modules – Power sources – Communication technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks – Mobile internet – Wired communication

8 Hours

Unit II

Programming the Microcontroller for IOT

Basics of sensors and actuators – Examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent microcontroller platform – Reading from sensors communication: Connecting microcontroller with mobile devices – Communication through bluetooth and USB – Connection with the internet using wifi / Ethernet

10 Hours

Unit III

Resource Management in The Internet of Things

Clustering - Software agents - Data synchronization - Clustering for scalability -Software agents for object - Data synchronization - Fundamental concepts of agility and autonomy-Enabling autonomy and agility by the internet of things-Technical requirements for satisfying the new demands in production

10 Hours

Unit IV

Business Models for the Internet of Things

Sensor-Actuator technologies and middleware as a basis for a DiY service creation framework – Semantic interoperability as a requirement for DiY creation - Value creation in the internet of things- -Semantic web - Ontology - The internet of things in context of EURIDICE - Business impact

9 Hours

Unit V

From the Internet of Things to the Web of Things

Resource-oriented architecture and best practices- Designing REST full smart things - Physical mashups: Recomposing the physical world :Energy aware mashup , Business intelligence mashup: RESTful EPCIS, A mashup editor for the smart home –Web enabling constrained devices - The future web of things

8 Hours

Unit VI[$]

Problem analysis- Logistics systems integration targets- Integrating intelligent logistics

Total: 45 Hours

Reference(s):

1. Charalampos Doukas , *Building Internet of Things with the Arduino*, Create space, April 2012
2. Dieter Uckelmann et.al, *Architecting the Internet of Things*, Springer, 2011
3. Luigi Atzor et.al, *The Internet of Things: A survey*, Journal on Networks, Elsevier Publications, October, 2010
4. http://postscapes.com/
5. http://www.theinternetofthings.eu/what-is-the-internet-of-things

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

ONE CREDIT COURSES

15CSXA MATLAB FOR RESEARCHERS

1 0 0 1

Course Objectives

- To understand the basic Matlab programming techniques
- To learn the advanced advanced Matlab programming techniques
- To acquire the knowledge in data visualization and statistics

Course Outcomes (COs)

1. Understand the file i/o and string handling
2. Know the basic and advanced visualization tools

Matlab for Researchers

Data Types - Constants - Variables – Operators - Character Constants - Scripts - Operations - Control Structures - Input and Output Functions - Reading and Storing Data -Vectors and Matrices - Visualization and Programming - Solving Equations and Curve Fitting - Advanced Methods – Symbolics – Simulink - File I/O - Building GUIs - Graphics: 2D Plots, Printing Labels, Grid & Axes Box, Text In Plot, Bar And Pie Chart.

Total: 20 Hours

15CSXB ANDROID OS

1 0 0 1

Course Objectives

- To learn the fundamentals of android technology
- To understand the concepts of activities and intents in android
- To acquire knowledge on professional and advanced apps

Course Outcomes (COs)

1. Understand the fundamental concepts of android application development
2. Know the structure of android applications
3. Identify the importance activities and intents in android
4. Gain knowledge to make attractive user interface in android
5. Explicate the live application development

Android OS

Introduction to android technology-History of android-Architecture of android-Android application development-Android development kit-Android virtual device-Structure of android applications-Component of an android-Working with activities and intents-How to create activity-Activity task-Intents concepts-Making attractive user interface-Common components - Attractive components - Employing phone features-Live application development-Various professional and advanced apps.

Total: 20 Hours

15CSXC INTERNET MARKETING

1 0 0 1

Course Objectives

- To learn the fundamentals of internet marketing
- To understand the concepts of ATM
- To acquire knowledge to earn money through internet

Course Outcomes (COs)

1. Understand the fundamental concepts in internet computing strategy and planning
2. Know the concept of social media marketing
3. Identify the importance of ATM
4. Gain knowledge to make money through internet

Internet Marketing

Internet marketing overview-Website planning & development-Internet marketing strategy and planning - Search engine optimization-Social media marketing - Make E-Commerce website in 20 minutes - ATM (Any Time Money)-Introduction- ATM-Selling products through online modes-Making money via adsense and blogging - Explore your talent to earn money through internet-Affiliate marketing- Making tons of money part time-Making money as a freelancer.

Total: 20 Hours

15CSXD OPEN SOURCE DATABASE

1 0 0 1

Course Objectives

- To understand the basic data manipulation using MySQL
- To learn the advanced data manipulation using MySQL
- To acquire the knowledge in transaction concepts

Course Outcomes (COs)

1. Understand the fundamental data manipulation concepts in MySQL
2. Know the SQL for working with transactions

Open Source Database

Introduction to web applications - Introduction to PHP - Introduction to MySQL -Using MySQL from PHP - Building a forum -User interaction – Cookies - Session management – Security - Authentication (User logins) -Authorization (Permissions) – Encryption - Model view controller pattern - Designing large applications - Code generation - Cron scripts - Web services - Putting it all together.

Total: 20 hours