

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**COIMBATORE INSTITUTE OF TECHNOLOGY**

**VISION AND MISSION OF THE INSTITUTE**

**VISION**

The Institute strives to inculcate a sound knowledge in engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

**MISSION**

The mission of CIT is to impart high quality education and training to its students to make them World-Class Engineers with a foresight to the changes and problems, and pioneers to offer innovative solutions to benefit the nation and the world at large.

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**COIMBATORE INSTITUTE OF TECHNOLOGY**

**VISION AND MISSION OF THE DEPARTMENT**

**VISION**

To evolve as a Centre of Excellence in research, learning and consultancy, integrating Computer and Information Sciences with Natural Sciences and Engineering concepts to develop products and services for the benefit of the Industry and Society at large.

**MISSION**

- Mission 1 :** To impart value based technical education and entrepreneurial skills to the graduates through state-of-art infrastructure and innovative faculty.
- Mission 2 :** To educate students towards the design and development of intelligent products and services meeting global demands and standards.
- Mission 3 :** To promote collaborative learning and research with Industry, Government and International organizations for continuous knowledge transfer and enhancement.
- Mission 4 :** To develop globally competent engineers, capable of providing secure and "Out of the Box" computing and information technology solutions.
- Mission 5 :** To enable the graduates to adapt to the rapidly changing technology with strong fundamentals.

# **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

COIMBATORE INSTITUTE OF TECHNOLOGY

## **PROGRAMME EDUCATIONAL OBJECTIVES**

1. Apply application concepts of Computer Science and Engineering to solve practical and research problems.
2. Learn emerging concepts and cutting edge technologies to analyze current trends and future research issues in Information and Communication Technology.
3. Pursue life-long learning and research in the fields of Computer Science & Engineering and contribute to the growth in the respective fields and society at large.

# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## COIMBATORE INSTITUTE OF TECHNOLOGY

### PROGRAMME OUTCOMES

1. Basic fundamental knowledge in mathematical problem solving, general engineering and in depth knowledge in Computer Science and Engineering.
2. Ability to identify, analyze, design real life and business problems using suitable algorithms of varying complexity.
3. Ability to produce cost effective, high quality and maintainable software products and solutions for meeting the global requirements by deploying the emerging techniques, tools and software engineering methodologies.
4. Recognize the risk, compliance and regulatory requirements of operating systems, virtualization techniques and research challenges and economic benefits in an organization.
5. Basic knowledge in parallel architecture and parallel algorithms used to design and development of R&D problems for lifelong learning.
6. Able to work in a team using modern software engineering tools, project management techniques to develop products for the societal needs and ability to comprehend, communicate & document effectively.
7. Be able to apply machine learning algorithms and soft computing techniques to solve problems of moderate complexity.
8. To obtain sound knowledge base and skill sets to develop and expand professional careers in fields related to human-computer interaction and mobile application development for the design and implementation of intelligent system.
9. Describe the limitations and challenges of working in a mobile and wireless environment as well as the business and research opportunities presented by these technologies.
10. Ability to enable efficient organization of data storage that facilitates information retrieval for big data analytics using statistical algorithms.
11. Ability to design, implement and manage secure networking solutions using the emerging technologies and the state of the art network appliances in accordance with international standards and laws.
12. Progress successfully in their profession and recognize the importance of self-education and life-long learning.

# COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Curriculum from the Academic Year 2015 - 2016 onwards

### Under Choice Based Credit System

Name of the degree : M. E. (Full-time)

Specialization : COMPUTER SCIENCE AND ENGINEERING

#### Semester I

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS11	Graph Theory and Finite State Automata	3	0	0	3	FC
2.	15MCS12	Design and analysis of Algorithms	3	2	0	4	PC
3.	15MCS13	Software Engineering Methodologies	3	2	0	4	PC
4.	15MCS14	Parallel Processing Architecture	3	0	0	3	PC
5.	15MCS15	Advanced Operating Systems	3	0	0	3	PC
6.		Elective - I	3	0	0	3	PE
		<b>TOTAL</b>				<b>20</b>	

#### Semester II

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS21	Database Engineering	3	2	0	4	PC
2.	15MCS22	XML and Web Services	3	2	0	4	PC
3.		Elective - II	3	0	0	3	PE
4.		Elective - III	3	0	0	3	PE
5.		Elective - IV	3	0	0	3	EEE
6.	15MCS23	Mini Project	0	0	0	3	EEC
		<b>TOTAL</b>				<b>20</b>	

**Semester III**

S. No.	Course Code	Course Title	L	T	P	C	CAT
1.	15MCS31	Virtualization Techniques	3	0	0	3	PC
2.		Elective V	3	0	0	3	PE/EEE
3.	15MCS32	Mobile Application Development Laboratory	0	0	6	3	PC
		<b>TOTAL</b>				<b>9</b>	

**Semester IV**

S. No.	Course Code	Course Title	L	T	P	C	CAT
1.	15MCS41	Project Work and Viva Voce				18	EEC
		<b>TOTAL</b>				<b>18</b>	

**TOTAL CREDITS : 67****FOUNDATION COURSES (FC)**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCS11	Graph Theory and Finite State Automata	3	0	0	3

**PROFESSIONAL CORE (PC)**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCS12	Design and analysis of Algorithms	3	2	0	4
2.	15MCS13	Software Engineering Methodologies	3	2	0	4
3.	15MCS14	Parallel Processing Architecture	3	0	0	3
4.	15MCS15	Advanced Operating Systems	3	0	0	3
5.	15MCS21	Database Engineering	3	2	0	4
6.	15MCS22	XML and Web Services	3	2	0	4
7.	15MCS31	Virtualization Techniques	3	0	0	3
8.	15MCS32	Mobile Application Development Laboratory	0	0	6	3

**LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCS23	Mini Project	0	0	0	3
2.	15MCS41	Project work and Viva Voce	-	-	-	18

## LIST OF PROFESSIONAL ELECTIVES

### SEMESTER I

#### Electives

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE01	Cryptography and Network Security	3	0	0	3
2.	15MCSE02	Multimedia Systems	3	0	0	3
3.	15MCSE03	Open Source systems	3	0	0	3

### SEMESTER II

#### Electives

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE04	Internet Technologies	3	0	0	3
2.	15MCSE05	Data Warehousing and Data Mining	3	0	0	3
3.	15MCSE06	AdHoc Networks	3	0	0	3
4.	15MCSE07	Cloud Computing	3	0	0	3
5.	15MCSE08	Secure Software Engineering	3	0	0	3
6.	15MCSE09	Information Security	3	0	0	3
7.	15MCSE10	Service Oriented Architecture	3	0	0	3
8.	15MCSE11	Software Metrics and Measurements	3	0	0	3
9.	15MCSE12	Machine Learning Techniques	3	0	0	3

### SEMESTER III

#### Electives

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE13	Big Data Analytics	3	0	0	3
2.	15MCSE14	Human Computer Interaction	3	0	0	3
3.	15MCSE15	Bio informatics	3	0	0	3
4.	15MCSE16	Social Network Analysis	3	0	0	3
5.	15MCSE17	Internet of Things	3	0	0	3
6.	15MCSE18	Web Engineering	3	0	0	3
7.	15MCSE19	Parallel Algorithms	3	0	0	3
8.	15MCSE20	Wireless Sensor Networks	3	0	0	3

## LIST OF EMPLOYABILITY ENHANCEMENT ELECTIVES (EEE)

### Electives

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSEE01	Embedded and real-time systems	3	0	0	3
2.	15MCSEE02	Enterprise Resource Planning	3	0	0	3
3.	15MCSEE03	Software Testing and Quality Assurance	3	0	0	3
4.	15MCSEE04	Information Storage Management	3	0	0	3
5.	15MCSEE05	Business Intelligence	3	0	0	3
6.	15MCSEE06	Software Project Management	3	0	0	3

FC - Foundation Course

PC - Professional Core

PE - Professional Elective

EEC - Employability Enhancement Course

# COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Curriculum from the Academic Year 2015 - 2016 onwards

### Under Choice Based Credit System

Name of the degree : M. E. (PART TIME)

Specialization : COMPUTER SCIENCE AND ENGINEERING

#### Semester I

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS11	Graph Theory and Finite State Automata	3	0	0	3	FC
2.	15MCS12	Design and analysis of Algorithms	3	2	0	4	PC
3.		Elective - I	3	0	0	3	PE
		<b>TOTAL</b>				<b>10</b>	

#### Semester II

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS21	Database Engineering	3	2	0	4	PC
2.	15MCS22	XML and Web Services	3	2	0	4	PC
3.		Elective - II	3	0	0	3	PE
		<b>TOTAL</b>				<b>11</b>	

#### Semester III

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS13	Software Engineering Methodologies	3	2	0	4	PC
2.	15MCS14	Parallel Processing Architecture	3	0	0	3	PC
3.	15MCS15	Advanced Operating Systems	3	0	0	3	PC
		<b>TOTAL</b>				<b>10</b>	

**Semester IV**

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.		Elective - III	3	0	0	3	PE
2.		Elective - IV	3	0	0	3	EEE
3.	15MCS23	Mini Project	0	0	0	3	EEC
		<b>TOTAL</b>				<b>9</b>	

**Semester V**

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS31	Virtualization Techniques	2	2	0	3	PC
2.		Elective V	3	0	0	3	PE/EEE
3.	15MCS32	Mobile Application Development Laboratory	0	0	6	3	PC
		<b>TOTAL</b>				<b>9</b>	

**Semester VI**

S. No.	Course Code	Course Name	L	T	P	C	CAT
1.	15MCS41	Project Work and Viva Voce				18	EEC
		<b>TOTAL</b>				<b>18</b>	

**TOTAL CREDITS : 67****FOUNDATION COURSES (FC)**

S. No.	Subject Code	Course Name	L	T	P	C
1.	15MCS11	Graph Theory and Finite State Automata	3	0	0	3

**PROFESSIONAL CORE (PC)**

S. No.	Subject Code	Course Name	L	T	P	C
1.	15MCS12	Design and analysis of Algorithms	3	2	0	4
2.	15MCS13	Software Engineering Methodologies	3	2	0	4
3.	15MCS14	Parallel Processing Architecture	3	0	0	3
4.	15MCS15	Advanced Operating Systems	3	0	0	3
5.	15MCS21	Database Engineering	3	2	0	4
6.	15MCS22	XML and Web Services	3	2	0	4
7.	15MCS31	Virtualization Techniques	3	0	0	3
8.	15MCS32	Mobile Application Development Laboratory	0	0	6	3

**LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCS23	Mini Project	0	0	0	3
2.	15MCS41	Project work and Viva Voce	-	-	-	18

**LIST OF PROFESSIONAL ELECTIVES****SEMESTER I****Electives**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE01	Cryptography and Network Security	3	0	0	3
2.	15MCSE02	Multimedia Systems	3	0	0	3
3.	15MCSE03	Open Source systems	3	0	0	3

**SEMESTER II & IV****Electives**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE04	Internet Technologies	3	0	0	3
2.	15MCSE05	Data Warehousing and Data Mining	3	0	0	3
3.	15MCSE06	AdHoc Networks	3	0	0	3
4.	15MCSE07	Cloud Computing	3	0	0	3
5.	15MCSE08	Secure Software Engineering	3	0	0	3
6.	15MCSE09	Information Security	3	0	0	3
7.	15MCSE10	Service Oriented Architecture	3	0	0	3
8.	15MCSE11	Software Metrics and Measurements	3	0	0	3
9.	15MCSE12	Machine Learning Techniques	3	0	0	3

**SEMESTER V****Electives**

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSE13	Big Data Analytics	3	0	0	3
2.	15MCSE14	Human Computer Interaction	3	0	0	3
3.	15MCSE15	Bio informatics	3	0	0	3
4.	15MCSE16	Social Network Analysis	3	0	0	3
5.	15MCSE17	Internet of Things	3	0	0	3
6.	15MCSE18	Web Engineering	3	0	0	3
7.	15MCSE19	Parallel Algorithms	3	0	0	3
8.	15MCSE20	Wireless Sensor Networks	3	0	0	3

## LIST OF EMPLOYABILITY ENHANCEMENT ELECTIVES (EEE)

### Electives

S. No.	Course Code	Course Name	L	T	P	C
1.	15MCSEE01	Embedded and real-time systems	3	0	0	3
2.	15MCSEE02	Enterprise Resource Planning	3	0	0	3
3.	15MCSEE03	Software Testing and Quality Assurance	3	0	0	3
4.	15MCSEE04	Information Storage Management	3	0	0	3
5.	15MCSEE05	Business Intelligence	3	0	0	3
6.	15MCSEE06	Software Project Management	3	0	0	3

FC - Foundation Course

PC - Professional Core

PE - Professional Elective

EEC - Employability Enhancement Course

# 15MCS11 - GRAPH THEORY AND FINITE STATE AUTOMATA

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To provide fundamental ideas on Graph Theory and Automata Theory for the study of Computer Science.

### COURSE OUTCOME

CO1 : Understand basic notations of Graph Theory.

CO2 : Understanding of Finite State and Pushdown Automata.

CO3 : Knowledge on Regular Languages and Context-Free Languages.

CO4 : Learn the concepts of relationship between Regular Language and Context-Free Language.

### GRAPHS AND TRANSPORT NETWORK

Graphs - Sub Graphs - Weighted Graphs - Connectedness - Components - Euler Graph - Hamiltonian Graph - Shortest Path - Travelling Salesman Problem - Transport Network - Max-Flow Min-Cut Theorem.

(9)

### GRAPHS ON SURFACES AND ENUMERATION OF GRAPHS

Planar Graphs - Detection of Planarity - Kuratowski's Graph - Trees - Spanning Trees - Finding Minimal Spanning Tree - Types of Enumeration - Counting Labeled and unlabeled Trees - Polya's Counting Theorem.

(9)

### COLORING, COVERING AND MATCHING

Vertex Coloring - Edge Coloring - Chromatic Number - Chromatic Partitioning - Chromatic Polynomial - Four Color Problem - Matching - Covering in Bipartite Graphs - Perfect Matching.

(9)

### FORMAL LANGUAGES AND FINITE AUTOMATA

The Chomsky's Hierarchy: Grammar and Languages - Ambiguity - Pumping Lemma for Regular Languages - Finite Automata: Definition, Designing of Finite Automata - NonDeterminism: Definition, Equivalence of NFAs and DFAs - Regular Expressions: Definition, Equivalence with Finite Automata.

(9)

### CONTEXT-FREE LANGUAGES AND TURING MACHINES

Context-free Grammars: Chomsky Normal Form (CNF) of Context-Free Grammars, - Pushdown Automata: Definition, Equivalence with Context-Free Grammars - Non Context-Free Languages: Pumping Lemma for Context-Free Languages - Turing Machines - The Halting Problem.

(9)

**TOTAL : 45**

## REFERENCES

1. Narsingh Deo, *"Graph Theory: With Application to Engineering and Computer Science"*, PHI, 2003.
2. Michael Sipser, *"Introduction to the Theory of Computation"*, Thomson Learning, Second Edition, 2005.
3. R.J. Wilson, *"Introduction to Graph Theory"*, Pearson Education, Fourth Edition, 2003.
4. Reinhard Diestel, *"Graph Theory"*, II Edition, Springer Publications, 2006.
5. John E. Hopcroft, Rajeev Motwani and Jeffery D. Ullman, *"Automata Theory, Languages, and Computation"*, Pearson Education, Third. Edition, 2008.

# 15MCS12 - DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To study analysis of algorithms, algorithm design techniques and their applications.

### COURSE OUTCOME

**CO1** : Ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

**CO2** : Understand different algorithm design techniques like brute -force, divide and conquer, greedy, branch and bound, back tracking ,dynamic programming and heuristic algorithms.

**CO3** : Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

### ALGORITHM ANALYSIS

Fundamentals of algorithmic Problem Solving - Asymptotic Notations , Basics of NP-Hard and NP-Completeness, Mathematical Analysis of Non-recursive Algorithm - Mathematical Analysis of Recursive Algorithm - Empirical Analysis of Algorithms. (7)

### DIVIDE AND CONQUER

General Method- Binary Search - Finding the Maximum and Minimum- Merge Sort - Quick Sort - Strassen's Matrix Multiplication. (7)

### GREEDY METHOD

General Method - Knapsack Problem - Tree Vertex Splitting - Job Sequencing with Deadlines - Optimal Merge Patterns - Single Source Shortest Paths. (7)

### DYNAMIC PROGRAMMING

General Method - Multistage Graphs - All-Pairs Shortest Paths - Single Source Shortest Path - Optimal Binary Search Trees - String Editing - 0/1 Knapsack Problem - Traveling Salesperson Problem - Flow Shop Scheduling. (7)

### BACKTRACKING

General Method - 8 Queens Problem - Graph Coloring -Hamiltonian Cycles- Knapsack Problem. (7)

### BRANCH AND BOUND

General Method - 0/1 Knapsack Problem - Traveling Salesperson Problem. (4)

### HEURISTIC ALGORITHMS

Genetic Algorithm- Ant Colony Optimization- Bee Colony Optimization - Particle Swarm Optimization - Simulated Annealing. (6)

**TOTAL : 45 + 30 = 75**

## REFERENCES

1. *Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, "Computer Algorithms/C++", Universities Press, Second Edition, 2007.*
2. *Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, Third Edition, 2011.*
3. *T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press, Third Edition, 2011.*
4. *A.V.Aho, J.E. Hopcroft and J.D.Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, Fourth Edition, 2009.*
5. *Jason Brownlee, "Clever Algorithms: Nature-Inspired Programming Recipes", Lulu Enterprises, January 2011.*

# 15MCS13 - SOFTWARE ENGINEERING METHODOLOGIES

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*Understand the Software Engineering principles, design methodologies and practices for the development and testing of quality software.*

### COURSE OUTCOME

**CO1** : *Ability to understand, define and document user requirements*

**CO2** : *Selection and Application of appropriate software design, development Methodologies and testing techniques.*

**CO3** : *Ability to perform estimations, project scheduling and monitoring activities.*

**CO4** : *Knowledge on configuration management, Quality Assurance Activities and Quality Standards.*

### SOFTWARE PROCESS AND PROCESS MODELS

Introduction - Software Engineering Practice - Software process: A Generic Process Model - Prescriptive Process models - Unified Process.

**Agile Development** : Agile process - Extreme Programming, Scrum, Dynamic Systems Development Method (DSDM), Lean Software Development. Process Assessment and Improvement, Process Framework - CMM & CMMI maturity Models. **(8)**

### REQUIREMENTS ENGINEERING

Requirements Engineering- Identifying stake holders-Multiple Viewpoints-Eliciting Requirements-Developing Use Cases-Building Requirements Model-Negotiating requirements-validating requirements. Requirements specification: Desirable characteristics and Components of a SRS -Structure of a SRS document. **(5)**

### SOFTWARE ARCHITECTURE AND DESIGN

**Software Architecture** : Role of software architecture- Architectural views-Architectural Styles-Documenting architectural design. Software Design: Design Concepts -Abstraction- Modularity-Cohesion-Coupling-Open closed principle. Function Oriented Design: Dataflow diagrams & Structured charts-Structured Design Methodology. Object Oriented design: Objects and classes -Unified Modeling language (UML)- Design Methodology.

**Detailed Design** : Logic/Algorithm Design-State modeling of classes-Verification-Metrics.

**User Interface Design** : The Golden Rules-User Interface Analysis and Design- Interface Analysis-Interface Design Steps-Web App Interface Design. **(11)**

## SOFTWARE TESTING

**A strategic approach to software testing** : Verification & Validation-Software testing Strategy Big picture- Test Strategies for conventional software: Unit testing-Integration testing. Test Strategies for OO software: Unit testing and Integration testing in the OO context. Test Strategies for Web Apps- Validation testing: Criteria-Alpha and Beta testing. System testing: Recovery test- Security test- Stress test-Performance test-deployment test and Regression testing.

**Black Box Testing** : Equivalence - Boundary Value - Cause effect and State based testing.

**White box testing techniques** : Control Flow based criteria-statement coverage, branch and condition coverage- Path testing-Data Flow testing and Mutation testing. **(9)**

## MANAGING SOFTWARE PROJECTS

**Software Project estimation-Decomposition techniques** : Software sizing-problem based estimation- LOC based estimation-FP based estimation-Process based estimation-Empirical estimation models: COCOMO.

**Project Scheduling** : Basic principles-Defining the task set-Scheduling-Work Break down Structure- Time Line Charts-Tracking the Schedule. **(6)**

## QUALITY MANAGEMENT & ASSURANCE

Software Configuration Management- Elements-baselines-configuration items-SCM Process.

**Software Quality** : McCall and ISO 9126 quality factors-Cost of quality-QC and QA-achieving software quality.

**Software Quality Assurance** : Elements of SQA-SQA tasks, Goals and Metrics-SQA Plan. Software Reliability-ISO 9000 Quality Standard- Informal and Formal Technical Reviews- CASE tools. **(6)**

**TOTAL : 45+30=75**

## REFERENCES

1. Roger S.Pressman, "Software Engineering - A Practitioner's Approach", McGraw Hill Education(India), Seventh Edition, 2014.
2. Pankaj Jalote, "Software Engineering-A Precise Approach", Wiley India, 2010.
3. Yogesh Singh, Ruchika Malhotra, "Object-Oriented Software Engineering", PHI Learning P.Ltd,2012.
4. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning P. Ltd, Third Edition, 2013.

# 15MCS14 - PARALLEL PROCESSING ARCHITECTURE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*Learn the basic concepts of different parallel processing architectures, instruction and thread level parallelisms and the relevant memory design and storage features.*

### COURSE OUTCOME

**CO1** : *Understand the architecture and components of multiprocessors, vector processors and RISC.*

**CO2** : *Knowledge on the instruction and thread level parallelisms and their application in practice.*

**CO3** : *Understand the virtual memory, Disk I/O concepts and the related performance issues.*

### REVIEW OF FUNDAMENTALS

Quantitative Principles of Computer Design - Basics of Pipelining: Implementation-Pipeline Hazards-Performance Issues. **(8)**

### INSTRUCTION-LEVEL PARALLELISM AND LIMITATIONS

Instruction-Level Parallelism: Concepts and Challenges - Basic Compiler Techniques for Exposing ILP - Static Prediction - Dynamic Prediction - Dynamic Scheduling - Hardware Based Speculation - Limitations of ILP. **(9)**

### MULTIPROCESSOR AND THREAD LEVEL PARALLELISM

Symmetric Shared Memory Architectures - Performance of Symmetric Shared Memory Multiprocessors - Distributed Shared Memory and Directory Based Coherence - Synchronization: The Basics - Models of Memory Consistency. **(9)**

### MEMORY DESIGN AND STORAGE

Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory And Virtual Machines - Storage Systems: Disk Storage- I/O Performance, Reliability Measures, And Benchmarks. **(10)**

### VECTOR PROCESSOR AND RISC ARCHITECTURE

Vector Processor: Architecture - Issues - Effectiveness of Compiler Vectorization - Vector performance. RISC Architecture: Survey of RISC Architecture - SPARC, PA-RISC. **(9)**

**TOTAL : 45**

## REFERENCES

1. John L. Hennessy, David A. Patterson *"Computer Architecture A Quantitative Approach"*, Morgan Kaufmann Publishers, Fourth and Second Edition, 2007.
2. Kai Hwang and Faye Briggs, *"Computer Architecture And Parallel Processing"*, McGraw hill International Edition, Singapore, 2000.
3. Carl Hamachar, Zvonco Vranesic and Safwat Zakv, *"Computer Organization"*, McGraw hill, 2002.

# 15MCS15 - ADVANCED OPERATING SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To gain knowledge on advanced concepts in distributed operating systems, multiprocessor operating systems and real time operating systems.

### COURSE OUTCOME

**CO1** : Ability to analyze the issues in process synchronization in distributed and multiprocessor Systems.

**CO2** : Identify and implement appropriate process scheduling algorithm in distributed and real-time environment.

**CO3** : Knowledge on distributed file systems and shared memory concepts.

### DISTRIBUTED CLOCK AND PROCESS SYNCHRONIZATION

Introduction - Issues - Communication Primitives - Inherent Limitations - Lamport's Logical Clock - Vector Clocks - Causal Ordering - Global State.

Distributed Mutual Exclusion: Classification of Mutual Exclusion Algorithms - Non-Token Based Algorithms - Lamport's Algorithm - Ricart-Agrawala Algorithm - Token-Based Algorithms - Suzuki-Kasami's Broadcast Algorithm - Singhal's Heuristic Algorithm - Raymond's Tree based Algorithm. **(9)**

### DISTRIBUTED DEADLOCK DETECTION

Introduction - Handling Strategies - Issues - Centralized Deadlock Detection Algorithms- Distributed Deadlock Detection Algorithms - Hierarchical Deadlock Detection Algorithms - Agreement Protocols - Classification - Solutions - Applications. **(9)**

### DISTRIBUTED RESOURCE MANAGEMENT

Distributed File systems: Architecture - Mechanisms - Design Issues - Distributed Shared Memory: Architecture - Algorithms - Memory Coherence - Protocols - Design Issues - Distributed Scheduling: Issues in Load Distributing - Components - Algorithms. **(10)**

### MULTIPROCESSOR OPERATING SYSTEMS

Introduction - Structures - Design Issues - Threads - Process Synchronization - Processor Scheduling - Memory Management: Mach Operating System. **(8)**

### REAL TIME OPERATING SYSTEMS

Characteristics of Real Time Systems - Safety and Reliability - Types of Real Time Tasks - Timing Constraints - Modeling Timing Constraints - Real Time Task Scheduling: Characteristics -Classification - Clock Driven Scheduling - Event Driven Scheduling - Hybrid Schedulers - Earliest Deadline First Scheduling - Rate Monotonic Algorithm. **(9)**

**TOTAL : 45**

## REFERENCES

1. *Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw-Hill, Reprint 2011.*
2. *Rajib Mall, "Real Time Systems: Theory and Practice", Pearson Education, Second Edition, 2009.*
3. *Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", John Wiley & Sons Incorporated, Ninth Edition, 2009.*
4. *Pradeep K.Sinha, "Distributed Operating System-Concepts and Design", PHI, First Edition, 2003.*

# 15MCS21 - DATABASE ENGINEERING

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To learn the basic concepts of databases, advanced data models, database design, query processing, optimization and transaction management.

### COURSE OUTCOME

**CO1** : Ability to design relational databases and develop SQL queries for practical applications.

**CO2** : Understanding of the advanced database concepts like temporal, multimedia, spatial and Distributed databases.

**CO3** : Ability to perform database normalization, tuning and recovery operations.

**CO4** : Knowledge on database storage structures, indexing mechanisms and query optimization techniques

## INTRODUCTION TO DATABASE SYSTEMS

Database System Concepts and Architecture. Relational Data Model - Relational Database Constraints- Relational Algebra. Entity Relationship (ER) Model- ER to Relational Mapping. SQL: Schema Definition - Constraints - Queries - Triggers and Views - Embedded SQL - Dynamic SQL. Database Design: Functional Dependencies and Normalization for Relational Databases. **(11)**

## STORAGE AND INDEXING

RAID Technology. Indexing Structures for Files- Types of Single Level Ordered Indexes-Multilevel Indexes- Dynamic Multilevel indexes using B-Trees and B+ trees- Indexes on Multiple Keys. **(9)**

## QUERY AND TRANSACTION PROCESSING

**Query Processing** : Heuristics in Query Optimization, Selectivity and Cost Estimates in Query Optimization- Semantic Query Optimization. Database Tuning in Relational Systems.

**Transaction Processing** : Concepts - Desirable properties of Transactions- Characterizing Schedules based on Recoverability-Serializability. Concurrency Control Techniques - Two Phase Locking-Timestamp Ordering - Multiversion Concurrency Control- Validation Concurrency Control. Database Recovery Techniques- Recovery Concepts- Recovery based on Deferred and Immediate updates- Shadow Paging. **(12)**

## ADVANCED DATABASE MODELS AND SECURITY

Active Databases - Temporal Databases- Spatial Databases- Multimedia Databases- Deductive Databases. Security: Discretionary Access Control- Mandatory Access Control - Role-based Access Control - SQL injection-Challenges of Database Security. **(6)**

## **DISTRIBUTED DBMS**

Distributed Database Concepts- Types of Distributed Database Systems- Distributed Database Architectures- Data Fragmentation- Replication-Allocation Techniques. Query Processing and optimization. Overview of Transaction Management- Concurrency Control and Recovery in Distributed Databases.

**(7)**

**TOTAL : 45 + 30 = 75**

## **REFERENCES**

1. *Ramez Elmasri and Shamkant B.Navathe, "Fundamentals of Database Systems", Pearson Education Inc, Sixth Edition, 2011.*
2. *M.Tamer Ozsu and Valduriez, "Principles of Distributed Database Systems", Springer, Third Edition, 2011.*
3. *Abraham Silberschatz, Hendry F.Korth, S.Sudharshan, "Database System Concepts", Tata Mc Graw Hill, Sixth Edition, 2010.*

# 15MCS22 - XML AND WEB SERVICES

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To acquire in-depth knowledge of XML, XML Technology, Web Services and Web service Architectures.

### COURSE OUTCOME

- CO1** : Design and code data transfer scripts using XML languages for the transfer of data over Business networks and the Internet.
- CO2** : Validate XML documents with the use of Document Type Definitions and schemas according to industry standards and Use of SOAP and Building a Web Service.
- CO3** : Understand Web Services and its Infrastructure.
- CO4** : Validate XML code and associated DTDs and schemas using a XML editing tool so that the XML code can be used within business and Deploying and Publishing Web Services.

### XML TECHNOLOGY FAMILY

XML - benefits - Advantages of XML over HTML - EDL -Databases - XML based standards -DTD -XML Schemas - X- Files - XML processing - DOM -SAX- presentation technologies -XSL - XFORMS - XHTML - voice XML - Transformation - XSLT - XLINK - XPATH -XQ (9)

### WEB SERVICES ARCHITECTURE

Web services technology stack - logical view - composition of web services - deployment view - from application server to peer to peer - process view - life in the runtime. (9)

### WEB SERVICES BUILDING BLOCK

Transport protocols for web services - messaging with web services - protocols - SOAP -describing web services - WSDL - Anatomy of WSDL - manipulating WSDL - web service policy - Discovering web services - UDDI - Anatomy of UDDI- Web service inspection - Ad- Hoc Discovery - Securing web services. (9)

### IMPLEMENTING XML IN E-BUSINESS

B2B - B2C Applications - Different types of B2B interaction - Components of e-business XML systems - ebXML - Rosetta Net Applied XML in vertical industry - Web services for mobile devices. (9)

### XML AND CONTENT MANAGEMENT

Semantic Web - Role of Meta data in web content - Resource Description Framework - RDF schema - Architecture of semantic web - content management workflow - XLANG -WSFL. (9)

**TOTAL : 45 + 30 = 75**

## REFERENCES

1. Ron schmelzer et al, "*XML and Web Services*", Pearson Education, 2002.
2. Sandeep Chatterjee and James Webber, "*Developing Enterprise Web Services: An Architect's Guide*", Prentice Hall, 2004.
3. Frank P. Coyle, "*XML, Web Services and the Data Revolution*", Pearson Education, 2002.
4. Keith Ballinger, "*.NET Web Services Architecture and Implementation*", Pearson Education, 2003.
5. Henry Bequet and Meeraj Kunnumpurath, "*Beginning Java Web Services*", Apress, 2004.
6. Russ Basiura and Mike Batongbacal, "*Professional ASP.NET Web Services*", Apress, CS9258.

## 15MCS23 - MINI PROJECT

L	T	P	C
0	0	6	3

### **COURSE OBJECTIVE**

*To expose the students towards learning and identifying the real time problems and to acquire in depth working knowledge in the chosen area.*

### **COURSE OUTCOME**

**CO1** : *Identification of real time problem in the field of computing.*

**CO2** : *Acquire knowledge and skills in planning, scheduling, designing and implementation of the product / project using the appropriate tools.*

### **SCOPE OF PROJECT WORK**

- Identification of real time problem in the field of computing
- Developing a mathematical model for solving the identified problem.
- Finalization of system requirements and specification.
- Proposing different solutions for the problem based on literature survey.
- Future trends in providing alternate solutions.
- Consolidated report preparation on the work done.

# 15MCS31 - VIRTUALIZATION TECHNIQUES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*Understanding the different virtualization technologies - server, storage and network virtualization and its benefits.*

### COURSE OUTCOME

- CO1** : *Understand the important components Virtual Machine and its deployment.*
- CO2** : *Recognize the different forms of virtualization and their historical roots and to understand the functionality of different virtualization products and approaches.*
- CO3** : *Understand the various types of workplace virtualization (PCs, tablets) the associated challenges and ability to create roadmaps for an optimally virtualized IT infrastructure.*
- CO4** : *Understand different maturity levels in managing virtualization and the changes to be made to IT operations and operational processes.*

### OVERVIEW OF VIRTUALIZATION

Basics of Virtualization - Virtualization Types - Desktop Virtualization - Network Virtualization - Server and Machine Virtualization - Storage Virtualization - System-level or Operating Virtualization - Application Virtualization-Virtualization Advantages - Virtual Machine Basics - Taxonomy of Virtual machines - Process Virtual Machines - System Virtual Machines - Hypervisor - Key Concepts **(7)**

### CLOUD COMPUTING

Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand provisioning - Elasticity in cloud -Egs of IaaS providers - PaaS - Egs. Of PaaS providers - SaaS - Egs. Of SaaS providers - Public, Private and Hybrid clouds. **(5)**

### SERVER CONSOLIDATION

Hardware Virtualization - Virtual Hardware Overview - Server Virtualization - Physical and Logical Partitioning - Types of Server Virtualization - Business cases for Server Virtualization - Uses of Virtual server Consolidation - Planning for Development - Selecting server Virtualization Platform **(8)**

### NETWORK VIRTUALIZATION

Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design - WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization-VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFI's Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation - Isec L2TPv3 Label Switched Paths - Control-Plane Virtualization-Routing Protocols-VRF - Aware Routing Multi-Topology Routing. **(10)**

## **VIRTUALIZING STORAGE**

SCSI- Speaking SCSI- Using SCSI buses - Fiber Channel - Fiber Channel Cables - Fiber Channel Hardware Devices - iSCSI Architecture - Securing iSCSI - SAN backup and recovery techniques - RAID - SNIA Shared Storage Model - Classical Storage Model - Host based Architecture - Storage based architecture - Network based Architecture **(8)**

## **VIRTUAL MACHINES PRODUCTS**

Introduction to Xen Virtual machine monitors- Xen API - Introduction to VMware - VMware products - VMware **(7)**

**TOTAL : 45**

## **REFERENCES**

1. *William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.*
2. *Chris Wolf , Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress 2005.*
3. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*
4. *Kumar Reddy and Victor Moreno, "Network virtualization", Cisco Press, July, 2006.*
5. *James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.*
6. *David Marshall, Wade A. Reynolds, Dave McCrory, "Advanced Server Virtualization: VMware and Microsoft Platforms in the Virtual Data Center", Auerbach Publications, May 17, 2006.*

# 15MCS32 - MOBILE APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	6	3

**ASSESSMENT : PRACTICAL**

## **COURSE DESCRIPTION**

This project-oriented course examines the principles of mobile application design and development. Students will learn application development on the Android platform.

## **TOPICS**

- Memory management; user interface design; user interface building; input methods; data handling; network techniques and URL loading; and, finally, specifics such as GPS and motion sensing.
- Students are expected to work on a project that produces a professional-quality mobile application. Projects will be deployed in real-world applications.
- Course work will include project conception, design, implementation, and pilot testing of mobile phone software applications

## 15MCS41 - PROJECT WORK AND VIVA VOCE

L	T	P	C
			18

### **COURSE OBJECTIVE**

*To expose the students towards learning and identifying the research/ application problems and to acquire in depth working knowledge in the chosen area .*

### **COURSE OUTCOME**

**CO1** : *Ability to identify and document the research / application oriented problem.*

**CO2** : *Demonstrate learning and knowledge access techniques using Conferences, Journal Papers and participation in research activities.*

**CO3** : *Acquire knowledge and skills in planning, scheduling, designing and implementation of the product / project using the appropriate tools.*

**CO4** : *Inculcate the practice of publishing the papers in Conferences and Journals*

### **SCOPE OF PROJECT WORK**

- Problem Identification and scope definition.
- A statement of system / process specifications proposed to be developed.
- Identification of constraints and alternate solutions
- Scheduling of activities.
- Implementation Phase (Hardware / Software / both).
- Testing & Validation of the developed system.
- Paper presentation in the Conference / Journals
- Consolidated report preparation.

# 15MCSE01 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the theory of cryptography, encryption, decryption algorithms, different security issues and threats and the use of authentication methods and Intrusion Detection System.

### COURSE OUTCOME

- CO1** : Ability to identify and analyze various security attacks and threats and use the fundamental knowledge on cryptographic theory in real world applications.
- CO2** : Ability in designing suitable encryption, decryption algorithms for ensuring secure communication.
- CO3** : Design and develop various key management and authentication techniques for trusted applications.
- CO4** : Selection and application of suitable intrusion detection techniques in practical Applications.

### INTRODUCTION

Security Attacks - Security Services - Security Mechanisms - Basics of number theory : Prime Numbers- Euler's and Fermet's-Modular arithmetic-Euclid Algorithm - Polynomial Fields - Classical Encryption Techniques : Symmetric Cipher Model - Substitution Techniques - Transposition Techniques. Block Cipher : Cipher Principles - Modes of Operation -Data Encryption Standard - Strength of DES . Advanced Encryption Standard : Evaluation criteria for AES - AES Cipher (12)

### PUBLIC KEY CRYPTOGRAPHY

Principles of Public key Cryptosystem - RSA Algorithm. Public Key Cryptosystems : Key Management - Diffie-Hellman Key Exchange - Elliptic Curve Arithmetic - Elliptic Curve Cryptography. (9)

### AUTHENTICATION AND HASH FUNCTION

Authentication Requirements - Authentication Functions - Message Authentication Codes -Message Digest Algorithm (MD5) - Secure Hash Algorithm-SHA-2 - Digital Signature Standard. (8)

### AUTHENTICATION APPLICATIONS

Kerberos - X.509 Authentication Service - Fingerprint Authentication - Public-Key Infrastructure. Electronic Mail Security : PGP-S/MIME - IP Security - Web Security. (8)

### INTRUSION DETECTION SYSTEM

Intruders - Intrusion detection - Password Management - Malicious Software : Viruses and Related Threats - Virus Countermeasures - Distributed DoS attacks. Firewalls : Firewall Design Principles - Trusted Systems. (8)

**TOTAL : 45**

## REFERENCES

1. *William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Fifth Edition, 2010.*
2. *Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Second Edition, 2013.*
3. *Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, Third Edition, 2013.*
4. *Wade Trappe, Lawrence C. Washington, "Introduction to Cryptography with coding theory", Pearson, Second Edition, 2011.*
5. *Wenbo Mao, "Modern Cryptography-Theory and Practice", Pearson Education, New Delhi, 2006.*
6. *Bruce Schneier, "Applied Cryptography", John Wiley and Sons, New York, 2004.*

## 15MCSE02 - MULTIMEDIA SYSTEMS

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

To gain knowledge on multimedia elements, various compression techniques, data and file format standards, Multimedia database management system and synchronization.

#### COURSE OUTCOME

**CO1** : Knowledge in learning the basic elements of multimedia and need for compression and various compression techniques used for efficient transmission of multimedia data.

**CO2** : Knowledge about data and file format standards and analyze the importance of real time scheduling.

**CO3** : Analyze the role of communication subsystem and the need of multimedia data transmission.

#### MULTIMEDIA SYSTEM DESIGN

Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system- Defining objects - Multimedia Data Interface standards - Multimedia databases. (6)

#### DATA AND FILE FORMAT STANDARDS

Rich Text Format - TIFF - RIFF - MIDI - JPEG DIB - AVI Indeo File Format - MPEG Standards- TWAIN: Objectives - Architecture - New WAVE RIFF file format - PDF File Format- multidimensional Index Structures: k-d Trees - Point Quad Tree - M-X Quad Tree - R Trees. (10)

#### COMPRESSION AND DECOMPRESSION

The Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale and Still Video Image Compression -Video Image Compression - Audio Compression. (10)

#### DATABASE MANAGEMENT SYSTEM

**Real time** : Notion of real time - Real Time and multimedia. Resource management: Resources - Requirements - Components and Phases - Allocation scheme - Continuous Media Resources Model.

**Process management** : Earliest Deadline First - Rate Monotonic - Processor Utilizations - Scheduling of Continuous Media Task. File systems: Multimedia File System.

**Database systems** : Multimedia database management system-characteristics of MDBMS - Data analysis-Data structure-Operations on data - Integration in a Database model. (9)

#### MULTIMEDIA COMMUNICATION SYSTEMS AND APPLICATION

Application subsystem-Transport Subsystem-Synchronization: Introduction-Notion of synchronization-Presentation requirements-A Reference model for Multimedia Synchronization: Existing classification Approaches -The Synchronization Reference Model-Synchronization in distributed environment-Multimedia Applications for Media Communication: Video Conferencing-Teleconferencing-Multimedia applications for Media Entertainment: Virtual Reality-Interactive Video. (10)

**TOTAL : 45**

## REFERENCES

1. Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.
2. Ralf Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education Limited- Sixth Impression, 2009.
3. [http://www.images.adobe.com/www.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/PDF32000\\_2008.pdf](http://www.images.adobe.com/www.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/PDF32000_2008.pdf) (PDF File Format).

## 15MCSE03 - OPEN SOURCE SYSTEMS

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

Learn importance of FOSS and gain knowledge on Linux, different open sources non-relational data bases, Python, PERL and MDA.

#### COURSE OUTCOME

**CO1** : Students shall be able to understand the importance of FOSS.

**CO2** : Ability to create and manipulate non-relational data bases.

**CO3** : Ability to write programs using PHP, Python and manipulate SQL data base.

**CO4** : Ability to configure and use Apache web services, acquire knowledge to develop software models using MDA.

#### FOSS PHILOSOPHY AND LINUX PACKAGE

Introduction to Software Terminologies - Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/Linux and the Free Software Movement , Advantages of Free Software and GNU/Linux, FOSS usage , trends and potential - global and Indian-Free Software Licenses(GPL, LGPL, AGPL). Installing software - from source code as well as using binary packages - Understanding build systems - constructing make files and using make, using autoconf and autogen to automatically generate make files tailored for different development environments. **(9)**

#### OPEN SOURCE NON RELATIONAL DATABASES

NoSQL definition - relational Vs non-relational database - working with NoSQL - Running MongoDB - Getting A Database Connection - Inserting Data into A Collection - Accessing Data From a Query - CouchDB-Developing with CouchDB - Example application - Deploying CouchDB. **(9)**

#### OPEN SOURCE PROGRAMMING LANGUAGES

PHP: Introduction - Programming in web environment - variables - constants - data types -operators - Statements - Functions - Arrays - OOP - String Manipulation and regular expression - File handling and data storage - PHP and SQL database - PHP and LDAP - PHP Connectivity - Sending and receiving E-mails - Debugging and error handling - Security - Templates. **(9)**

#### PYTHON

Syntax and Style - Python Objects - Numbers - Sequences - Strings - Lists and Tuples -Dictionaries - Conditionals and Loops - Files - Input and Output - Errors and Exceptions - Functions - Modules - Classes and OOP - Execution Environment. **(9)**

## OPEN SOURCE TOOLS AND TECHNOLOGIES

Web Server: Apache Web server -Google Web server- Working with Web Server - Configuring and Using apache web services MDA: Introduction to MDA - Genesis of MDA - Meta Object Facility - UML - UML Profiles - MDA Applications- case studies. (9)

**TOTAL : 45**

## REFERENCES

1. *Mike McGrath, "Linux in easy steps, Fifth Edition", Tata McGraw-Hill, Fifth Edition 2010.*
2. *N. B. Venkateshwarlu, "Introduction to Linux: Installation and Programming", First Edition, BS Publishers, 2006.*
3. *Steve Suchring, "MySQL Bible", John Wiley, 2007.*
4. *Steven Holzner, "PHP: The Complete Reference", TMH Edition; 2007*
5. *J.Chris Anderson, "CouchDB : Definitive Guide", First Edition, O'Reilly series, 2010.*
6. *Wesley J.Chun, "Core Python Programming", Prentice Hall, 2007*
7. *Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", Addison Wesley, 2002.*

# 15MCSE04 - INTERNET TECHNOLOGIES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the basics of internet, working of web browser, web scripting, xml technology and server side concepts.

### COURSE OUTCOME

**CO1** : Understanding of the concept of the web servers and its working

**CO2** : Acquire in depth knowledge in web services using the latest server side technologies

**CO3** : Ability to design and develop web server applications using Node JS and Angular JS

### WEB SERVERS

Web Protocols- Working of web browser - Browser & Server Communication - Web Server Functions - Web Security - Fire Wall - Proxy Servers - Virtual Directories - MIME - HTTP Headers - Deployment using web servers. (7)

### WEB PROGRAMMING

HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes - DHTML - CSS3-Selectors-Box model-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations. (6)

### JAVASCRIPT AND JQUERY

Java Script - Core JavaScript - lexical structure- types-values and variables- expression and operators-statements-objects-arrays-functions- classes and moduels- pattern matching with regular expressions-java script in web browser-the window objects-scripting documents-handling events. (8)

### ANGULARJS

An Overview of the AngularJS Life Cycle-Integrating AngularJS with Existing JavaScript and jQuery- Adding AngularJS to the Node.js Environment-Bootstrapping AngularJS in an HTML Document- Creating a Basic AngularJS Application-Using AngularJS Templates to Create Views- Implementing Directives in AngularJS Views- Implementing AngularJS Services in Web Applications (9)

### NODE.JS

Using Events, Listeners, Timers, and Callbacks in Node.js-5 Handling Data I/O in Node.js- Accessing the File System from Node.js- Implementing HTTP Services in Node.js- Implementing Socket Services in Node.js- Scaling Applications Using Multiple Processors in Node.js- Implementing Express in Node.js (8)

### MONGODB

Understanding NoSQL and MongoDB- Manipulating MongoDB Documents from Node.js- Accessing MongoDB Documents from Node.js- Advanced MongoDB Concepts (7)

**TOTAL : 45**

## REFERENCES

1. *Deitel & Deitel, "Internet & World Wide Web How to Program", Pearson Education India, Fifth Edition, 2011.*
2. *David Flanagan, "JavaScript: The Definitive Guide", O'Reilly Media, Inc. May 2011.*
3. *Brad Dayley and Node.js, "MongoDB and AngularJS Web Development", Addison-Wesley Professional. 2014.*
4. *Brad Green, Shyam Seshadri "AngularJS", O'Reilly; First Edition, April 2013.*
5. *Negrino and Smith, "Javascript for the World Wide Web", Fifth Edition, Peachpit Press,2003.*

## 15MCSE05 - DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

To gain knowledge on various Data Mining tasks, Data Warehousing and application oriented Data Mining concepts.

#### COURSE OUTCOME

**CO1** : Knowledge in the basic concepts of data warehousing and data mining.

**CO2** : Ability to create large multidimensional data storage and carry out OLAP operations.

**CO3** : Ability to apply the concepts, algorithm, techniques and tools for developing practical applications.

#### DATA WAREHOUSE

Data Warehouse-Introduction-Multidimensional Data Model-Data Warehouse Architecture-Data Warehouse Implementation-From Data Warehousing to Data Mining. (7)

#### DATA MINING AND DATA PREPROCESSING

Data Mining-On What Kind of Data-Data Mining Functionalities-Classification of Data Mining Systems-Data Mining Task Primitives-Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining. Data Preprocessing: Needs Preprocessing the Data - Data Cleaning-Data Integration and Transformation-Data Reduction- Discretization and Concept Hierarchy Generation. (8)

#### ASSOCIATION RULES

Definition-Apriori Algorithm-Partitioning Algorithm-Pincer Search -Dynamic Item Set Counting Algorithm-FP Tree Algorithm-Discussion on different Algorithms-Incremental Algorithm-Border Algorithm-Generation of Association Rules. (10)

#### CLUSTERING AND CLASSIFICATION

Cluster analysis - Types of data - Categorization of major clustering methods - Partitioning - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree - Issues regarding classification and prediction - Classification by decision tree induction. (10)

#### MINING COMPLEX TYPES OF DATA

Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex-Data Objects-Mining Spatial Databases-Mining Multimedia Databases-Mining Time-Series and Sequence Data Mining Text Databases-Mining the World Wide Web. Case studies. (10)

**TOTAL : 45**

## REFERENCE BOOKS

1. *Jiawei Han & Micheline Kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.*
2. *Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.*
3. *Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.*
4. *Pieter Adriaans, Dolf Zantinge, "Data Mining ", Pearson Education, 2009, Delhi.*
5. *Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson Education, New Delhi, 2003.*
6. *George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education , 2003.*
7. *Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, 2001.*

## 15MCSE06 - ADHOC NETWORKS

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

To acquire knowledge on wireless Ad Hoc network concepts, protocols, Quality of Service and Energy management.

#### COURSE OUTCOME

**CO1** : Understand the fundamentals of wireless Ad Hoc networks.

**CO2** : Acquire knowledge on the various MAC, Network and Transport layer protocols for wireless Ad Hoc networks.

**CO3** : Acquire knowledge in the area of QoS and energy management requirements in wireless Ad Hoc networks.

#### MAC PROTOCOLS

Ad Hoc Wireless Networks: Introduction - Issues in Ad Hoc Wireless Networks -Issues in Designing a MAC Protocol for Ad hoc Wireless Networks - Classification of MAC Protocols: Contention-Based - MACAW, Busy tone multiple Access Protocol, Contention-Based with Reservation Mechanisms-Distributed Packet Reservation Multiple Access Protocol, Collision Avoidance Time Allocation Protocol, Five phase Reservation protocol, Real Time Medium Access control Protocol - Contention -Based with Scheduling Mechanisms-Distributed Priority Scheduling. **(9)**

#### ROUTING PROTOCOL

Issues in Designing a Routing Protocol for Ad hoc Wireless Networks - Classifications of Routing Protocols: Table-Driven-DSDV, On-Demand-DSR,AODV, Hybrid - Zone routing protocol - Hierarchical Routing Protocol - Power Aware Routing Protocols **(9)**

#### MULTICAST ROUTING

Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols - Bandwidth efficient Multicast Routing Protocol, Multicast Routing Protocol Based on zone Routing, Multicast Core Extraction Distributed Ad Hoc Routing, MAODV - Mesh-Based- On Demand Multicast Routing Protocol, Dynamic core based Multicast Routing protocols, Core Assisted Mesh Protocol, Energy efficient Multicast Routing Protocol - Multicasting with Quality of Service Guarantees - Application Dependent Multicast Routing. **(10)**

#### TRANSPORT LAYER AND SECURITY PROTOCOLS

Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP over Ad Hoc Wireless Networks, Secure Routing in Ad Hoc Wireless Networks **(7)**

## **QUALITY OF SERVICE & ENERGY MANAGEMENT**

Issues and challenges in providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions: MAC Layer Solutions-Cluster TDMA, DBASE - Network Layer Solutions - Ticket Based Protocol, On-Demand Link-State multipath QoS Routing Protocol - QoS Frameworks for Ad Hoc Wireless Networks-INSIGNIA, INORA, SWAN- Energy Management in Ad Hoc Wireless Networks, Classification of Energy Management Schemes - Battery Management Schemes, System Power Management Schemes. **(10)**

**TOTAL : 45**

## **REFERENCES**

1. *C.Siva Ram Murthy, B.S.Manoj, "Ad-Hoc Wireless Networks- Architectures and Protocols", Prentice Hall, 2012.*
2. *C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2009.*
3. *Carlos DE Morais Cordeiro. Dharma Prakash Agrawal, " Ad-Hoc and Sensor Networks - Theory and Applications", Second Edition, 2006.*

# 15MCSE07 - CLOUD COMPUTING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the concepts of Virtualization, cloud architecture, deployment models and design of trusted cloud Computing system.

### COURSE OUTCOME

**CO1** : Understand the concepts of Virtualization, cloud architecture and deployment models.

**CO2** : Ability to identify the architecture, infrastructure and delivery models of cloud computing.

**CO3** : Ability to address the core issues of cloud computing such as security, privacy .

**CO4** : Design Cloud Services and Set a private cloud.

### CLOUD ARCHITECTURE AND MODEL

Technologies for Network-Based System - System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics - Cloud Services - Cloud models (IaaS, PaaS, SaaS) - Public vs Private Cloud -Cloud Solutions - Cloud ecosystem - Service management - Computing on demand. (9)

### VIRTUALIZATION

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices -Virtual Clusters and Resource management - Virtualization for Data-center Automation. (9)

### CLOUD INFRASTRUCTURE

Architectural Design of Compute and Storage Clouds - Layered Cloud Architecture Development -Design Challenges - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources. (9)

### PROGRAMMING MODEL

Parallel and Distributed Programming Paradigms - Map Reduce , Twister and Iterative MapReduce - Hadoop Library from Apache - Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim (9)

### SECURITY IN THE CLOUD

Security Overview - Cloud Security Challenges and Risks - Software-as-a-Service Security - Security Governance - Risk Management.

Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security - Identity Management and Access Control- - Autonomic Security. (9)

**TOTAL : 45**

## REFERENCES

1. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*
2. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.*
3. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.*
4. *Kumar Saurabh, " Cloud Computing - insights into New-Era Infrastructure", Wiley India, 2011.*

## 15MCSE08 - SECURE SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

*Understanding specific security issues associated with different phases of the software development, the principles and best practices required in building secure software.*

#### COURSE OUTCOME

- CO1** : *Ability to understand the various security issues encountered in software development and the properties of secure software.*
- CO2** : *Gain knowledge on security principles and practices to be deployed in software requirements design, coding and testing of real-life applications.*
- CO3** : *Ability to understand the features of enterprise software security framework, maturity practices and adopt them in practice.*

### SECURITY : A SOFTWARE ISSUE

Introduction- the problem - Software Assurance and Software Security - Threats to software security - Sources of software insecurity - The Benefits of Detecting software security defects early. Defining Properties of Secure Software: Core properties of secure software- Influential properties of secure Software. Building a Security Assurance Case and Incorporating into the SDLC. **(9)**

### REQUIREMENTS ENGINEERING FOR SECURE SOFTWARE

Introduction: Importance of Requirements engineering-Quality requirements-security requirements engineering - Requirements elicitation: Overview of several elicitation methods-Elicitation evaluation criteria.

Requirements Prioritization: Identify candidate prioritization methods- Prioritization technique comparison- Recommendations for requirements prioritization. **(7)**

### SECURE SOFTWARE ARCHITECTURE AND DESIGN

Introduction - Architectural risk analysis: Software Characterization-Threat Analysis- Architectural Vulnerability Assessment-Risk Likelihood Determination-Risk Impact Determination -Risk Mitigation Planning - software security knowledge : security principles- security guidelines and attack patterns. **(11)**

### SECURE SOFTWARE CODING AND TESTING

Code analysis: Common software code vulnerabilities- Source code Review- Software Security testing: Contrasting software testing and software security testing -Functional Testing-Risk based Testing- Security testing considerations throughout the SDLC: Unit testing- Testing libraries and executable files-Integration testing- System Testing. **(9)**

## **GOVERNANCE AND MANAGING FOR MORE SECURE SOFTWARE**

Governance and security: Definitions of Security governance- Characteristics of effective security governance and management.

Adopting an Enterprise Software Security framework: Common Pitfalls-Framing the Solution-Define a Road Map.

Security and project management: Project scope- Project plan- Resources- Estimating the nature and duration of required resources- Project and product risks- measuring software security- Maturity of Practice.

**(9)**

**TOTAL : 45**

## **REFERENCES**

1. *Julia H. Allen, Sean Barnum et al., "Software Security Engineering: A Guide for Project Managers", Addison Wesley, 2008.*
2. *Jason Grembi, "Secure Software Development : A Security Programmer's guide", Cengage Learning, 2008.*
3. *Richard Sinn, "Software Security Technologies :A Programmatic Approach", Cengage Learning, 2008.*

## 15MCSE09 - INFORMATION SECURITY

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

*Understand the basic principles of information security, security threats, attacks, important security technologies, tools and controls and to gain exposure to security laws, policies, standards, and industry practices for ensuring business continuity.*

#### COURSE OUTCOME

- CO1** : *Analyze and identify the security threats, attacks and device suitable security policies and standards.*
- CO2** : *Ability to plan, assess and device suitable risk control strategies in practice.*
- CO3** : *Ability to implement appropriate intrusion detection and prevention systems to ensure information availability.*
- CO4** : *Ability to apply various national, international laws and legal frameworks emphasizing responsibility and accountability at all levels in the organization.*

#### INTRODUCTION, NEED, ETHICAL AND PROFESSIONAL ISSUES

Introduction to Information Security - The History of Information Security- What Is Security - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. Ethics and Information Security - Codes of Ethics and Professional Organizations - Organizational Liability and the Need for Counsel. (7)

#### RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Documenting Results Recommended Practices in Controlling Risk. (6)

#### POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001 and its controls, NIST Security Models, VISA International Security Model, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies. (9)

#### SECURITY TECHNOLOGY: INTRUSION DETECTION, ACCESS CONTROL AND SECURITY TOOLS

Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools, Access Control Devices - Physical Security - Security and Personnel. (11)

## **BIOMETRIC CONTROLS AND WIRELESS NETWORKS SECURITY**

Biometrics :Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. Attacks on Wireless Networks: Other Security Risks in Wireless Networks, Management and Mitigations for Wireless Networks Attacks. **(7)**

## **LAWS AND LEGAL FRAMEWORK**

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) - Health Insurance Portability and Accountability Act (HIPAA) -Gramm-Leach-Bliley Act (GLBA) - Overview of Sarbanes-Oxley (SOX) - Building Security into Software/System Development Life Cycle. **(5)**

**TOTAL : 45**

## **REFERENCES**

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012 Reprint.*
2. *Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.*
3. *Faiyaz Ahamad, "Cyber Law and Information Security", Wiley dreamtech press,2013.*
4. *Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Revised Second Edition, 2013.*
5. *Mark Merkow and Jim Breithaupt, " Information Security - Principles & Practices", Pearson Education, 2011.*

# 15MCSE10 - SERVICE ORIENTED ARCHITECTURE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand SOA and gain knowledge into design and deployment of SOA based web services and security mechanism involved in SOA.

### COURSE OUTCOME

**CO1** : Develop and deploy simple and composite web services with SOA design principles.

**CO2** : To understand and describe the standards and technologies of modern web service implementations.

**CO3** : Ability to use development tools for the implementation of service oriented applications.

### UNDERSTANDING SOA

Introduction of SOA- SOA architecture fundamentals-Overview of SOA implementation methodology - SOA reference architecture - Service identification -Service specification- Service realization -Service life cycle. **(9)**

### DESIGNING SOA

Business architecture - Business motivation model -Business process management and modeling - Conditional business process models - The importance of semantics in SOA- Core information modeling- Defining type. **(9)**

### SERVICE ORIENTED DESIGN

Introduction to service-oriented design - WSDL related XML schema language - WSDL language -SOAP language- Service interface design tools- Steps to composing SOA-Considerations for choosing service layers -Considerations for positioning core SOA standards. **(9)**

### BUSINESS PROCESS DESIGN

Service design overview- Entity centric business service design- Application service design - Task centric business service design-Service design guidelines-WS-BPEL language basics- WS coordination. **(9)**

### SOA PLATFORM

WS addressing language- WS reliable messaging language-WS policy language - WS metadata exchange language- WS security language-SOA platform basics- SOA support in J2EE- SOA support in .NET.**(9)**

**TOTAL : 45**

### REFERENCES

1. Michael Rosen, Boris Lublinsky, Kevin T.Smith and Marc J.Balcer, "Applied SOA: Service-Oriented Architecture and Design Strategies", Wiley India Edition, 2008

2. *Thomas Erl, "Service-Oriented Architecture: Concepts, Technology and Design", Pearson Education, 2008.*
3. *Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2009.*
4. *Dan Woods and Thomas Mattern, "Enterprise SOA: Designing IT for Business Innovation", O'REILLY, 2006.*

# 15MCSE11 - SOFTWARE METRICS AND MEASUREMENTS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*Understand the fundamentals of measurements, models, measurement scales, basics of software metrics and the methods of data collection and analysis.*

### COURSE OUTCOME

**CO1** : *Ability to understand the basics of measurement theory and measurement scales*

**CO2** : *Acquire the fundamental knowledge of various software metrics*

**CO3** : *Knowledge in various data collection methods and analysis*

**CO4** : *Gain basic knowledge on reliability theory and models*

### FUNDAMENTALS OF SOFTWARE MEASUREMENT

Measurement: Measurement in software engineering - scope of software metrics. Basics of Measurement: representational theory of measurement-measurement and models- measurement scales and scale types - nominal scale - ordinal scale- interval scale- ratio scale- absolute scale - meaningfulness in measurement.

**(7)**

### GOAL BASED FRAMEWORK AND DATA COLLECTION

Classifying software measures- determining what to measure-software measurement validation. Empirical Investigation - Principles of empirical studies.

Software metrics data collection: Defining good data, data collection for incident reports, Data collection forms and reports, reliability of data collection procedures.

Analyzing software measurement data: Statistical Distributions and hypothesis testing, classical data analysis techniques, examples of simple analysis techniques, overview of statistical tests.

**(9)**

### MEASUREMENT OF PRODUCT ATTRIBUTES

Measuring internal product attributes: size - properties of software size - code size - design size - requirements analysis and specification size - functional size measures and estimators - Function Points - COCOMO II approach.

Measuring internal product attributes: structure - Aspects of structural measures: structural complexity properties - length, coupling, cohesion, custom attributes properties.

Control flow structure of program units: Flow graph model and the notion of structured programs - hierarchical measures - McCabe's cyclomatic complexity measure - code structure and test coverage measures. Design level attributes: global modularity- Tree impurity - Internal reuse - Information flow.

Object oriented structural attributes and measures: Measuring coupling and Cohesion in OO systems - OO length measures - OO reuse measurement - Design pattern use.

**(12)**

## **MEASURING EXTERNAL PRODUCT ATTRIBUTES**

Measuring external product attributes: Modeling software quality - measuring aspects of quality - Usability measures - Maintainability Measures-Security measures. **(5)**

## **PRODUCT AND PROCESS QUALITY METRICS**

Product quality metrics, In Process quality metrics - software maintenance metrics. In-process metrics for software Testing: Test Progress S curve, Testing defect arrivals over time, Testing defect backlog over time. **(7)**

## **SOFTWARE RELIABILITY MEASUREMENT**

Basics of reliability theory- software reliability problem - parametric reliability growth models: Jelinski-Moranda Model, other models based on Jelinski Moranda, littlewood model, littlewood-verrall model - the recalibration of software reliability growth predictions. **(5)**

**TOTAL : 45**

## **REFERENCES**

1. *Norman Fenton and James Bieman, "Software Metrics - A Rigorous & Practical Approach", CRC press, Third Edition, 2014.*
2. *Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2007.*
3. *International Function Point Users Group, "IT Measurement - A Practical Advice from the Experts", Pearson Education, Asia, 2002.*
4. *Roger S. Pressman, " Software Engineering-A Practitioner's approach", Mc Grawhill Education(India), 7e, 2014*

# 15MCSE12 - MACHINE LEARNING TECHNIQUES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the machine learning techniques - Bayesian, Decision tree, Clustering, Analytical and Instance based learning and to apply the techniques in computing.

### COURSE OUTCOME

- CO1** : Acquire Knowledge in various learning techniques like decision tree, Bayesian, Analytical, Inductive and Reinforced learning.
- CO2** : Identify and apply the appropriate machine learning techniques for classification, pattern recognition, optimization and decision problems.
- CO3** : Development of techniques in information science applications by applying computational intelligence and appropriate machine learning techniques.

### INTRODUCTION

Machine learning -Examples of Machine Learning applications-Learning Associations-Classification-Regression-Unsupervised Learning-Reinforcement Learning-Supervised learning: Learning a class from Examples-Regression-Model Selection and Generalization (9)

### DECISION-TREE LEARNING

Hypothesis space, consistency, and version space-List-then-eliminate algorithm-Classifying with a decision tree-Representational power of decision trees-TDIDT decision tree learning algorithm-Splitting criteria for TDIDT learning- Prediction and Over fitting-Training error, test error, prediction error-Independently identically distributed (iid) data-Overfitting-Occam's razor-Model Selection and Assessment -Model selection Controlling Overfitting in decision trees -Train, validation, test split (9)

### MULTILAYER PERCEPTRONS

The Perceptron-Training a Perceptron-Learning Boolean Functions-Multilayer Perceptrons- MLP as a Universal Approximator- Backpropagation Algorithm-Training Procedures-Hidden Markov model-Basic problems of HMM-Evaluation problem-Learning Model Parameters-The HMM with input-Model Selection in HMM (9)

### CLUSTERING

Similarity-Based Clustering-Unsupervised learning problems-Hierarchical Agglomerative Clustering (HAC)- Single-link, complete-link, group-average similarity- k-Means and Mixtures of Gaussians-Flat clustering-k-Means algorithms-Mixture of Gaussian model-EM-algorithm for mixture of Gaussian model (9)

### REINFORCEMENT LEARNING

**Single State case** : K-Armed Bandit-Elements of reinforcement learning-Model based Learning-Temporal Difference Learning-Generalization-Partially Observable States (9)

**TOTAL : 45**

## REFERENCES

1. *Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press, September 2014, ISBN 978-0-262-02818-9.*
2. *Mitchell, Tom, "Machine Learning", New York, McGraw-Hill, First Edition, 2003.*
3. *Stephen Marshland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC 2009.*
4. *Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press (MA) 2012.*

# 15MCSE13 - BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the concepts and financial value of big data analytics and to explore tools and practices for working with big data applications.

### COURSE OUTCOME

**CO1** : Ability to use Hadoop, Map Reduce Framework.

**CO2** : Ability to identify the areas for applying big data analytics for increasing the business outcome.

**CO3** : Contextually integrate and correlate large amounts of information to gain faster insights.

### 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 - Statistical Inference - Prediction Error. **(9)**

### SEARCH METHODS AND VISUALIZATION

Search by simulated Annealing - Stochastic, Adaptive search by Evaluation - Evaluation Strategies - Genetic Algorithm - Genetic Programming - Visualization - Classification of Visual Data Analysis Techniques - Data Types - Visualization Techniques - Interaction techniques - Specific Visual data analysis Techniques **(9)**

### 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 - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. **(9)**

### FRAMEWORKS

MapReduce - Hadoop, Hive, MapR - Sharding - NoSQL Databases - S3 - Hadoop Distributed File Systems - Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation. **(9)**

### R LANGUAGE

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

**TOTAL : 45**

## REFERENCES

1. Michael Berthold, David J. Hand, *"Intelligent Data Analysis"*, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, *"Mining of Massive Datasets"*, Cambridge University Press, 2012
3. Norman Matloff, *"The Art of R Programming: A Tour of Statistical Software Design"*, No Starch Press, USA, 2011.
4. Bill Franks, *"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics"*, John Wiley & sons, 2012.
5. Glenn J. Myatt, *"Making Sense of Data"*, John Wiley & Sons, 2007.

# 15MCSE14 - HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

Acquire knowledge on the needs of effective human computer interfaces, the components and design aspects of User Interfaces and to apply them in practice.

### COURSE OUTCOME

- CO1** : Gain knowledge on the desirable features of good user interfaces and the design process
- CO2** : Ability to design effective screens, web interfaces, system menus and navigational schemes and to identify suitable interaction devices .
- CO3** : Ability to identify the Internationalization aspects of User Interface Design and apply them in practice.

## INTRODUCTION TO USER INTERFACES

**Importance of User Interface** : Definition-Importance of good design-Benefits of good design-Characteristics of Graphical and Web Interfaces: Interaction styles-The Graphical User Interfaces-Popularity of graphics - The concept of direct manipulation - Advantages/Disadvantages of Graphical systems-Characteristics of GUI- The Web User Interface-Popularity and characteristics of Web Interface-Principles of User Interface Design. **(9)**

## USER INTERFACE DESIGN PROCESS

**The User Interface Design Process** : Designing for people-Seven Commandments-Common usability problems-measures of usability.

Know your user (or) Client: Important Human Characteristics in design- Human Considerations in the design - Human Interaction Speeds-Performance versus preference.

**Understand the business function** : Business definition and requirements analysis-determining basic business functions-Design Standards (or) Style Guides-Training and documentation needs. **(8)**

## INTERFACE AND SCREEN DESIGN

Interface Design Goals - Screen & Web page Meaning and purpose- Organizing Elements - consistency-Starting point-Ordering Data and Content - Navigation and Flow - Visually Pleasing Composition - Distinctiveness- Focus and Emphasis - Technological considerations in Interface Design. **(8)**

## DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES

**Structure of Menus** : Single-Sequential Linear- Simultaneous-Hierarchical-Connected-Event Trapping Menus. Functions of Menus: Navigation-Execution-displaying information-parameter input. Contents of Menus: Menu context-Menu Title-Choice Descriptions-Completion Instructions.

**Formatting of Menus** : Consistency-Display-Presentation-Organization-Complexity-Item arrangement-Ordering-Grouping- Selection support Menus.

Phrasing the menus: Menu Titles -Menu Choice description-Menu Instruction-Intent Indicators-Keybaord short cuts. Web site Navigation-Kinds of Graphical menus. **(8)**

### **WINDOWS AND INTERACTION DEVICES**

Window Characteristics- Components of a Window-Window Presentation Styles-Types of Windows-Organizing Window functions-The Web and the Browser.

Input Devices-Characteristics-Selection of proper input device. Output Devices-Screens-Speakers. **(7)**

### **INTERNATIONALIZATION AND ACCESSIBILITY**

International Considerations:-Localization-Cultural considerations-Words and Texts-Images and symbols-Colors, Sequence and functionality-Requirements determination and testing. Accessibility: Types of Disabilities-Accessibility Design. **(5)**

**TOTAL : 45**

### **REFERENCES**

1. *Wilbert O Galitz, "The Essential Guide to User Interface Design", Wiley India Pvt., Ltd., Third Edition, 2007.*
2. *Ben Shneidermann, "Designing the User Interface", Pearson Education Asia, Fifth Edition, 2013*
3. *Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, 2004.*

# 15MCSE15 - BIO INFORMATICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the basics of bio-informatics, information retrieval processing techniques and computational tools.

### COURSE OUTCOME

**CO1** : Students shall learn the basic aspects of the biological patterns, information retrieval strategies, sequence alignments and the issues in proteins and drug discovery.

**CO2** : Knowledge about information retrieval strategies, sequence alignment and issues in proteins and drug discovery.

**CO3** : Identify and formulate bio-informatics problems using machine learning approaches.

### BIOLOGY FOR BIOINFORMATICS

Basic concepts - cells- Archaeobacteria, Bio membranes, Nucleus, Organelles, Mitochondria, Chloroplasts, Viruses, Bacteria Phage, Genetic contents of a cell - Viral Proteins - Amino acid, DNA and RNA - Forms of DNA. (9)

### GENETIC CODE

Genome - Gene Expressions - Protein Synthesis - Transcription RNA - Processing- Capping- Splicing - Editing, Cell Signalling, DNA cloning Genomic library - cDNA library - Probes - Screening. Databases: Characteristics of Bioinformatics, Database - Categorizing, Navigating, Information Retrieval systems, Sequence Databases, Structure Databases. (9)

### SEQUENCE ALIGNMENT

Introduction to Sequence Alignment - dotplot - dotplots and sequence alignment - Measures of Sequence similarity - Alignment of two sequences using dynamic programming algorithm - Multiple Sequence Alignment - Applications - Phylogeny - Phylogenetic trees. (8)

### PROTEIN STRUCTURE DISCOVERY

Protein stability and folding - Applications of Hydrophobicity - Super position of structures - DALI - Evolution of protein Structures - Classification of Protein Structures - Protein structure prediction - and modelling - Assignment of protein structures to genomes - prediction of protein function - Drug Discovery and development. (8)

### MACHINE LEARNING IN BIOINFORMATICS

Gradient descent - EM/GEM algorithms -Markov chain Monte-Carlo methods - simulated annealing - Evolutionary & genetic algorithms: ACO, B-Colony and PSO. (11)

**TOTAL : 45**

## REFERENCES

1. *Orpita Bosu, Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University Press, 2007.*
2. *Arthur M Lesk, "Introduction to Bioinformatics", Oxford University Press, India, Third Edition, 2008.*
3. *Pierre Baldi and Søren Brunak, "Bioinformatics: the Machine Learning Approach", MIT Press, 1998.*
4. *David W. Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, Second edition, 2004.*

# 15MCSE16 - SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*To understand the evolution, components, modeling and visualization aspects of the social networks and gain knowledge on the mining of user behaviors in social networks.*

### COURSE OUTCOME

**CO1** : *Understanding of the internal components of the social network.*

**CO2** : *Ability to Model social network data and visualize social network.*

**CO3** : *Demonstrate the ability to mine the behaviors of the users in the social network.*

### INTRODUCTION

Networks-Relations and Structure- Relations and networks in the social and behavioral science-Social Network Data- Collection and application **(4)**

### MATHEMATICAL REPRESENTATIONS OF SOCIAL NETWORKS

Graphs Basic Definitions - Paths and Connectivity - Distance and Breadth-First Search - Network Data Sets: An Overview- Strong and Weak Ties - Triadic Closure - The Strength of Weak Ties -Tie Strength and Network Structure in Large-Scale Data - Tie Strength, Social Media, and Passive Engagement - Closure, Structural Holes, and Social Capital - Advanced Material: Betweenness Measures and Graph Partitioning **(6)**

### NETWORKS IN THEIR SURROUNDING CONTEXTS

Homophily - Mechanisms Underlying Homophily: Selection and Social Influence- Affiliation - Tracking Link Formation in Online Data -Positive and Negative Relationships-Structural Balance -Characterizing the Structure of Balanced Networks -Applications of Structural Balance- A Weaker Form of Structural Balance - Advanced Material: Generalizing the Definition of Structural Balance **(6)**

### INFORMATION NETWORKS AND THE WORLD WIDE WEB

The Structure of the Web -The World Wide Web - Information Networks, Hypertext, and Associative Memory - The Web as a Directed Graph - The Bow-Tie Structure of the Web - The Emergence of Web 2.0- Link Analysis and Web Search -Searching the Web: The Problem of Ranking - Link Analysis Using Hubs and Authorities - Page Rank Applying Link Analysis in Modern Web Search - Applications beyond the Web - Advanced Material: Spectral Analysis, Random Walks, and Web Search **(9)**

### NETWORK DYNAMICS

Structural Models - Cascading Behavior in Networks - Diffusion in Networks - Modeling Diffusion through a Network - Cascades and Clusters - Diffusion, Thresholds, and the Role of Weak Ties - Extensions of the Basic Cascade Model - Knowledge, Thresholds, and Collective Action - Advanced Material: The Cascade Capacity **(6)**

## **THE SMALL-WORLD PHENOMENON**

Six Degrees of Separation- Structure and Randomness - Decentralized Search -Modeling the Process of Decentralized Search - Empirical Analysis and Generalized Models - Core-Periphery Structures and Difficulties in Decentralized Search - Advanced Material: Analysis of Decentralized Search -Small Network Model **(6)**

## **SNA AND ONLINE SOCIAL NETWORKS**

Concepts: Services such as Facebook, LinkedIn, Twitter, CouchSurfing, etc. are using SNA to understand their users and improve their functionality **(8)**

**TOTAL : 45**

## **REFERENCES**

1. *Stanley Wasserman, Katherine Faust, "Social network analysis: methods and applications", Cambridge University Press, 1999 (Reprint).*
2. *David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.*
3. *Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.*

# 15MCSE17 - INTERNET OF THINGS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To learn the architecture and paradigms of IoT and the protocols for Internet-connected products.

### COURSE OUTCOME

**CO1** : Ability to design fully connected products by integrating Internet services and physical objects.

**CO2** : Ability to analyze, design and develop prototypes of Internet-connected products using appropriate tools.

**CO3** : Identifying, classifying and describing different kinds of Internet-connected product and its concepts.

## INTRODUCTION

Smart Objects - Challenges for Smart Objects - IP for Smart Objects: motivation and main challenges - Security for Smart objects - Web services for Smart Objects - Connectivity models for Smart Object Networks - Introduction to the Internet of Things: application scenarios, current solutions. **(9)**

## SMART OBJECTS AND LLNS

Hardware and Software - Energy Management - Communication for Smart Objects : IEEE 802.15.4: main features, topologies, addressing and MAC frame format - Low Power and Lossy Networks (LLN): Introduction to 6LoWPAN - 6LoWPAN architecture: simple, extended and ad-hoc networks - 6LoWPAN adaptation layer -Issues in determining IPv6 links in LLNs - IPv6 addressing in 6LoWPAN- 6LoWPAN forwarding: route-over and mesh under approaches- Neighbor Discovery optimizations and extensions to the ND protocol for 6LoWPAN networks **(11)**

## ROUTING IN LOW POWER AND LOSSY NETWORKS

Mesh-under and route-over solutions - Routing Requirements - Routing metrics - The IPv6 Routing Protocol for LLNs (RPL)- Protocol operation - use of destination oriented directed acyclic graphs - DODAG formation - RPL Messages **(9)**

## CoAP

Interaction Model - Messages and Request/Response Model - Resource observing - Service discovery - Resource discovery - CORE Link Format **(9)**

## APPLICATIONS

Case Study -Smart Cities and Urban automation - Home Automation - Building Automation - Structural Health Monitoring **(7)**

**TOTAL : 45**

## REFERENCES

1. J.-P. Vasseur, A. Dunkels, *"Interconnecting Smart Objects with IP: The Next Internet"*, Morgan Kaufmann, 2010.
2. Z. Shelby, C. Bormann, *"6LoWPAN: The Wireless Embedded Internet"*, Wiley, 2009
3. Z. Shelby, K. Hartke, K. Hartke, *"The Constrained Application Protocol (CoAP)"*, RFC 7252, 2014.

# 15MCSE18 - WEB ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

*Understand the Web Engineering components, models, tools and technologies and the project management aspects of Web Engineering and apply them in practice to develop effective Web Applications.*

### COURSE OUTCOME

**CO1** : *Ability to understand Web Engineering Components, Principles and Practices.*

**CO2** : *Ability to analyze web engineering models and design web applications.*

**CO3** : *Gain knowledge about technologies and tools for developing web applications*

### WEB ENGINEERING COMPONENTS

Web Engineering - Framework - Principles - Components - Best Practices - Process Flow - Generic Action and Tasks. Web Communication: Communication Activity-Formulation- Elicitation-Identifying WebApp Increments- Negotiation. Planning: Scope-Building a WebE Team-Managing Risk-Developing a Schedule-Managing Quality-Managing Change-Tracking the Project-Outsourcing WebE work. **(9)**

### MODELING AND WEB APP DESIGN

**Modeling Activity** : Concept-Modeling Frameworks-Modeling Languages.

**Analysis Modeling for WebApps** : Content Model- Interaction Model- Function Model and Configuration Model.

**WebApp Design** : Design goals-Design process. Interactive design: Preliminaries-Design Steps-Usability-Issues. Information Design : Information Architecture- Structuring the information space-Blueprints- Accessing Information-Wireframe Models.

**Functional Design** : Nature-Design process-Functional Architecture-Detailed Functional Design. **(12)**

### PATTERNS, TECHNOLOGIES AND TOOLS

**Design Patterns** : Patterns-WebApp Patterns - Pattern Repositories.

**Technologies and Tools** : Issues - Implementation Tools and technologies and Development Tools and technologies. **(6)**

### TESTING WEB APPLICATIONS

**Testing Concepts** : Dimensions of quality- Types of errors-Testing strategy-Test plan. Testing Process- Content Testing-User Interface Testing-Usability Testing-Compatibility Testing-Navigation Testing: Navigation syntax-Navigation semantics. Configuration Testing: Test the server side-Test the client side. Security and Performance Testing: WebApp Secure-WebApp Performance-Objective-Load Testing and Stress testing. **(9)**

## **CHANGE AND CONTENT MANAGEMENT**

WebApp Change-Change Management: Need-Issues-Change Management Activity-Identify the Objects-  
Control a change-Manage versions. Content management - Criteria for implementing a CMS: Volume  
Affect CMS-Population of content creators -Change volume Affect. Changing Nature of the Web and  
WebApps-Evolving Web Technologies and Web 2.0: Web 2.0-Technologies Support Web 2.0-Key issues-  
Next for Web 2.0.

**(9)**

**TOTAL : 45**

## **REFERENCES**

1. *Roger Pressman and David Lowe, "Web Engineering-A Practitioners Approach", Tata McGraw Hill, First Edition, 2008.*
2. *Gerti Kappel, Brigit Proll, Siegfried Reich, Werner Retschitzegger, "Web Engineering", John Wiley & Sons Ltd, 2006.*
3. *Douglas Comer, "The Internet Book: Everything you need to know about Computer Networking and How the Internet Works", Prentice Hall, Fourth Edition, 2006.*
4. *Jennifer Niederst Robbins, "Learning Web Design: A beginner's Guide to HTML, CSS, JavaScript and Web Graphics", O'Reilly, Fourth Edition, 2012.*

# 15MCSE19 - PARALLEL ALGORITHMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To learn the fundamental steps of designing Parallel programming algorithms, analyze the challenges and learn programming paradigms of MPI, OPENMP and CUDA.

### COURSE OUTCOME

**CO1** : Knowledge on global communication functions for distributed memory using MPI

**CO2** : Ability to develop programs for shared memory using pthreads and OpenMp

**CO3** : Ability to develop high performance parallel application using CUDA memory and thread model.

### DISTRIBUTED-MEMORY PROGRAMMING WITH MPI

Parallel Program design - Deploying Parallel programs - MPI program execution - MPI constructs - libraries - MPI send and receive - Point-to-point and Collective communication - MPI derived data types - Performance evaluation (9)

### SHARED MEMORY PROGRAMMING WITH PTHREADS

**Pthreads** : Execution - Critical Sections - Busy-Waiting - Synchronization primitives: mutexes, locks, semaphores, barriers - Cache Coherence and False Sharing using Pthreads - Matrix - Vector Multiplication using Pthreads. (9)

### OPENMP FOR SHARED MEMORY PROGRAMMING

OpenMP Execution Model - Handling variables - The Reduction Clause - Parallel for directive clause - Looping - Scheduling loops - Producers & Consumers Problem - Cache Coherence and False Sharing (9)

### CUDA BASICS AND THREADS

Program Structure - Device Memories and Data Transfer - Kernel Functions & Organization of Threads - Distinguishing threads using blockIdx and threadIdx variables. Synchronization and Scalability - Assigning and Scheduling Threads. (9)

### CUDA MEMORY AND PERFORMANCE

Cuda Device memory types Strategy for reducing memory traffic - Memory as a Limiting factor to parallelism - Performance Tuning: Dynamic Partitioning, Data Prefetching, Instruction Mix, Thread Granularity. (9)

**TOTAL : 45**

## REFERENCES

1. Peter S. Pacheco, *"An Introduction to Parallel Programming"*, Morgan-Kaufman, 2011, reprint 2014.
2. David.B.Kirk, Wen-mei W,Hwu, *" Programming Masively Parallel Processors - A Hands-on Approach"*, Elsevier, 2010.
3. Michael J Quinn, *"Parallel programming in C with MPI and OpenMP"*, Tata McGraw Hill, 2004.
4. Thomas Rauber,Gudula Runger, *"Parallel Programming for Multicore and Cluster Systems"*, Springer, 2011.
5. David E.Culler, Jaswinder Pal Singh, Anoop Gupta, *"Parallel Computer Architecture - A Hardware/ Software Approach"*, Morgan Kauffman Publishers, 2010.

# 15MCSE20 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of wireless sensor network.

### COURSE OUTCOME

- CO1** : Familiarize with the architectures and functions of wireless sensor network systems and Platforms.
- CO2** : Evaluate the performance of sensor networks and identify bottlenecks.
- CO3** : Expose students to emerging technologies and their potential impact.

### INTRODUCTION

Basics sensor network Architecture-Generation of sensor network - challenges - hardware and software components of wireless nodes-operating environment - Applications: Home control, Building Automation, Medical applications. **(9)**

### MAC PROTOCOLS

Schedule based protocols: Self-organizing MAC for Sensornets (SMACS), Low Energy Adaptive Clustering Hierarchy (LEACH) - Random Access based protocols - Sensor MAC protocol , IEEE 802.15.4 and Zigbee Reference Model - Super frame structure - Frame types - Modes of operation : Contention based channel Access, Beacon less mode. **(10)**

### ROUTING PROTOCOLS

Data Dissemination and Gathering - Challenges and Design Issues - Flooding - Sensor Protocols for Information via Negotiation (SPIN) - LEACH - Power Efficient Gathering in Sensor Information System (PEGASIS) - Directed Diffusion - Geographical routing. **(11)**

### TRANSPORT CONTROL PROTOCOLS

Design issues - Congestion Detection and Avoidance (CODA) - Event to Sink Reliable Transport (ESRT) - Reliable Multi Segment Transport (RMST) - Pump Slowly Fetch Quickly (PSFQ) - GARUDA - Ad-hoc Transport Protocol (ATP). **(8)**

### OPERATING SYSTEM AND PERFORMANCE MODELS

OS Design Issues - Features of Tiny OS , MANTIS - Performance Modeling of WSN : Performance Metrics - Basic Models: Traffic Models, Energy Models, Node model - Network models: MAC model, Routing Model, System Model. **(7)**

**TOTAL : 45**

## REFERENCES

1. *Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", Second Edition, John Wiley, 2011.*
2. *Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2010.*
3. *Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, First Edition, 2005.*
4. *Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2007*
5. *Jun Zheng, Abbas Jamalipour, " Wireless Sensor Networks - A Networking Perspective", Wiley India, 2014.*

# 15MCSEE01 - EMBEDDED AND REAL-TIME SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To acquire fundamental knowledge on features of embedded systems and issues related to real-time computing

### COURSE OUTCOME

**CO1** : Ability to design and develop embedded applications using timers, device drivers and communication ports.

**CO2** : Knowledge on design patterns in embedded systems.

**CO3** : Knowledge on features of RTOS, RTdatabase and RTnetworks.

### INTRODUCTION

Characteristics of Embedded Systems - Embedded Hardware Units and Devices - Embedded Software - System-on-Chip (SoC) - Application Specific IC(ASIC) - Design Process in embedded system: Design Metrics- Challenges in embedded system design- Design examples: Smartcard,Digital Camera. (7)

### TIMER & COMMUNICATION BUS

Timer and Counting Devices - WatchDog Timer- Real Time Clock-Serial Communication: Synchronous Peripheral Interface(SPI), Serial Connect Interface(SCI), Serial Interface(SI), Secure Digital Input Output(SDIO) - Serial Bus Communication Protocols: I2C Bus, CAN Bus, USB, FireWire-IEEE1394 Bus Standard. Parallel Bus Device Protocols: ISA Bus, PCI and PCI/X Bus, ARM Bus(AMBA). (9)

### DEVICE DRIVERS AND INTERRUPTS

Device Drivers- Interrupt Sources - Interrupt Servicing Mechanism- Interrupt Vector Table - Multiple Interrupt Calls and Priorities - Interrupt Latency - Interrupt Service Deadline- Software Over-riding of Hardware Priorities to meet Service Deadlines- Device Driver Programming - Virtual Device Drivers - Parallel Port Drivers - Serial Port Drivers - Device Drivers for Internal Programmable Timing Devices. (9)

### DESIGN PATTERNS FOR EMBEDDED SYSTEMS

Basic Structure of Design Patterns-Hardware Adapter Pattern- Mediator Pattern-Observer Pattern-Debouncing Pattern-Cyclic Executive Pattern - Static Priority Pattern-Simultaneous Locking Pattern-Single Event Receptor Pattern-Multiple Event Receptor Pattern (9)

### REAL-TIME SYSTEMS

Characteristics of Temporal Data-Concurrency Control: Locking based Protocols, Optimistic Concurrency Control Protocols - Speculative Concurrency Control - Real Time Communications: Soft Real-Time Communication in a LAN- Hard Real-Time Communication in a LAN: Global Priority Based Scheduling - Calendar Based Protocol- Bounded Access Protocols For LANs : IEEE 802.4- RETHER- Switched Real-Time Ethernet. Case Study: RTLinux, VxWorks, µC/OS-II. (11)

**TOTAL : 45**

## REFERENCES

1. *Rajkamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill, 2008.*
2. *Bruce Powel Douglass, "Design Patterns for Embedded Systems in C - An Embedded Software Engineering Toolkit", Newnes -2011.*
3. *Rajib Mall, "Real-Time Systems: Theory and practice", Pearson Education, 2007.*
4. *Phillip A. Laplante, "Real Time Systems Design and Analysis: An Engineer's Hand book" II Edition, Prentice Hall of India, New Delhi, 2000.*
5. *Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012.*

## 15MCSEE02- ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

Acquire knowledge on the basic features and benefits of ERP, related technologies and the major business modules of leading ERP packages in the industry.

#### COURSE OUTCOME

- CO1** : Ability to analyze, understand the operational aspects and recommend suitable ERP system that meets the organizational needs.
- CO2** : Define the implementation process and strategies, coordinate with vendors and consultants and monitor the implementation.
- CO3** : Gain exposure to major issues and challenges in ERP implementation, analyze the metrics and improve business process management .
- CO4** : Understand the core functions of ERP business modules, the features and benefits of industry popular ERP packages.

#### INTRODUCTION

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining -OLAP - SCM. **(9)**

#### ERP IMPLEMENTATION

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors , Consultants and Employees - Training and education- Project Management and Monitoring. **(10)**

#### THE ERP BUSINESS MODULES

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution. **(9)**

#### THE ERP MARKET & ERP - PRESENT AND FUTURE

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP. **(9)**

#### SAP

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench **(8)**

**TOTAL : 45**

## REFERENCES

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006 edition.
3. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2013.
4. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.

# 15MCSEE03 - SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

Acquire fundamental knowledge on software testing concepts, testing policies, goals and test case design strategies and obtain knowledge on software quality concepts, quality standards and process models.

### COURSE OUTCOME

**CO1** : Ability to design test cases for Black box and white box testing

**CO2** : Formulate testing policies and goals for organizational requirements.

**CO3** : Understanding of various levels of testing and test plans.

**CO4** : Ability to perform Software Quality Assurance activities and gain exposure to quality standards and process models such as ISO 9000 and CMMI.

### INTRODUCTION TO TESTING AND TESTING MATURITY MODEL

Introduction to Testing as an Engineering Activity: Role of Process in software Quality-Testing as a process-Overview of Testing Maturity Model. Testing Fundamentals: introduction, testing principles, the testers' role. Defects, Hypothesis and Tests: Origin of defects-Defect classes and repository. (4)

### STRATEGIES & METHODS FOR TEST CASE DESIGN-I

Introduction - Smart tester - Test Case Design strategies -using Black Box approach to test case design-Equivalence Class Partitioning-Boundary value analysis- Cause Effect Graphing-State transition testing-Black Box testing and COTs-Black Box methods and TMM level 2 goals. (6)

### STRATEGIES & METHODS FOR TEST CASE DESIGN- II

Using White box approach to test case design-Test Adequacy Criteria - coverage and control flow graphs-covering code logic-Paths and their role in white box based test design-Data flow and white box test design-loop testing-mutation testing. White Box Testing Methods and the TMM. (7)

### LEVELS OF TESTING

**The Need for Levels of Testing-Unit Tests** : Functions, procedures and methods as units. Preparing for unit test-Unit Test planning- Designing the unit tests, The Class as a Testable Unit: Special Considerations- Test Harness-Running and recording unit test results.

**Integration Tests** : Goals- Integration strategies for Procedures and Functions- Integration strategies for Classes-Designing Integration tests-Integration test Planning.

**System Test** : Different types-Functional testing, Performance testing, Stress Testing, Configuration testing-Security Testing-Recovery testing- Regression Testing- Alpha, Beta and Acceptance Tests. (7)

## TESTING PLANNING, DOCUMENTATION & REVIEWS

Test planning - Test Plan Components-Reporting test results -Role of the three critical groups.

**Review as a Testing Activity** : Expanding the testing activity umbrella, types of Reviews- Inspection and walk throughs - Review checklists - Requirements review, Design review, code review, test plan reviews - review metrics (5)

## SOFTWARE QUALITY AND QUALITY ASSURANCE

Software Quality - Garvin's Quality Dimensions - McCall's Quality Factors - ISO 9126 - Software Quality Dilemma - Achieving Software Quality.

Elements of Software Quality Assurance - SQA Tasks, Goals and Metrics- Formal Approaches to SQA- Statistical Software Quality Assurance - Software Reliability - SQA Plan. (8)

## SOFTWARE CONFIGURATION MANAGEMENT, QUALITY STANDARDS AND PROCESS MODELS

Need for Software Configuration Management - Nomenclature - SCM Activities: Identifications - Base lining - Configuration control - Status accounting and auditing.

**ISO 9001 standards** : Overview of ISO 9001:2000 standard - CMM: Levels of CMM and KPA's - CMMI: Background - Types of CMMI models - Process Maturity Levels in CMMI model. (8)

**TOTAL : 45**

## REFERENCES

1. Ilene Burnstein, "*Practical Software Testing*", Springer International Edition, 2010 Reprint.
2. Roger.S.Pressman, "*Software Engineering A Practitioner's Approach*", McGraw Hill Education (India), Seventh Edition, 2014.
3. Nina S Godbole." *Software Quality Assurance-Principles and Practice*", Narosa Publishing, 2011.
4. Yogesh Singh, "*Software Testing*", Cambridge University Press, 2012.
5. Watts S. Humphrey, "*Managing the Software Process*", Addison-Wesley, 2002.
6. Rajib Mall, "*Fundamentals of Software Engineering*", PHI, Third Edition, 2013.

## 15MCSEE04 - INFORMATION STORAGE MANAGEMENT

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

*Acquire knowledge on storage system architecture, data protection requirements, storage networking technologies and virtualization concepts and to gain insight into backup, restoration and replication mechanisms for ensuring business continuity and information availability.*

#### COURSE OUTCOME

- CO1** : *Ability to analyze and identify the data centre needs performance requirements and its storage architecture.*
- CO2** : *Select and implement suitable Data protection and storage solutions in practical applications to ensure information availability.*
- CO3** : *Ability to deploy storage networking techniques such as DAS, SAN and NAS.*
- CO4** : *Ability to plan and implement different forms of Virtualization and to use appropriate backup, restoration and replication methods to ensure business continuity.*

#### INTRODUCTION TO STORAGE TECHNOLOGY

Information Storage - Evolution of Storage Technology and Architecture - Data Centre Infrastructure - Key challenges in Managing Information - Information Lifecycle. Storage System Architecture: Component Storage System Environment - Disk Drive Components and Performance - Laws Governing Disk Performance - Logical Components of Host - Application Requirement and Disk performance. **(7)**

#### DATA PROTECTION AND INTELLIGENT STORAGE SYSTEMS

Implementation of RAID - RAID Array Components - RAID levels - RAID Comparison - RAID impact on Disk Performance - Hot Spares - Component of an Intelligent Storage System - High - end Storage Systems - Midrange Storage System. **(6)**

#### DIRECT ATTACHED STORAGE AND SCSI

Directly Attached Storage and Introduction to SCSI: Types of DAS - DAS benefits and limitations - Disc Drive Interfaces - Introduction to parallel SCSI - SCSI Command Model **(4)**

#### SAN AND NAS

**Storage Area Networks** : Fibre Channel overview - The SAN and its evolution - Components of SAN - FC Connectivity - Fibre Channel Ports - Fibre Channel Architecture- Zoning - Fibre Channel Login Types - FC Topologies. Network Attached Storage: General Purpose Servers vs NAS devices - Benefits of NAS - NAS file I/O- Components of NAS - NAS Implementation - NAS File Sharing Protocols - NAS I/O operations - factors affecting NAS performance and availability. **(9)**

## **IP SAN, CONTENT ADDRESSED STORAGE AND STORAGE VIRTUALIZATION**

**IPSAN** : iSCSI - FCIP - Content Addressed Storage: fixed content and archives - types of archives - features and benefits of CAS - CAS Architecture. Storage Virtualization: overview- Forms of Virtualization- Storage Virtualization Challenges - Types of storage Virtualization. **(10)**

## **INFORMATION AVAILABILITY AND MONITORING**

Introduction to Business Continuity - Information Availability - BC Terminology - Failure Analysis - Backup and Recovery - Backup Purpose - Backup Consideration - Backup - Granularity - Methods - Backup and Restore operations - Local Replication - source and target - uses of local replica - Data Consistency - Local Replication Technologies - Restore and Restart consideration - Creating Multiple replicas - Remote replication - Modes of remote Replication - Remote replication Technology - Network infrastructure. **(9)**

**TOTAL : 45**

## **REFERENCES**

1. *Emc<sup>2</sup> Corporation, "Information Storage and Management", Wiley, 2012.*
2. *Robert Spalding, "Storage Network - The Complete Reference", Tata McGraw Hill, Osborne, 2003.*

## 15MCSEE05 - BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OBJECTIVE

To understand the basic concepts of business intelligence, data integration, data modeling and reporting techniques associated with business intelligence.

#### COURSE OUTCOME

- CO1** : Ability to understand Transaction Processing, Analytical applications and describe the need for business intelligence.
- CO2** : Demonstrate understanding of technology and processes associated with business intelligence framework
- CO3** : Ability to identify the business metrics, KPIs and prepare enterprise reports and recommendations to achieve the business goals.

#### INTRODUCTION TO BUSINESS INTELLIGENCE

Introduction to Digital Data and Its Types- Structured, Semi-Structured and Unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions and Concepts, BI Framework. **(8)**

#### COMPONENTS OF BUSINESS INTELLIGENCE

Data Warehousing Concepts and Its Role in BI; BI Infrastructure Components - BI Process, BI Technology, BI Roles and Responsibilities, Business Applications of BI, BI Best Practices **(6)**

#### BASICS OF DATA INTEGRATION

Concepts of Data Integration , Needs and Advantages of using Data Integration , Introduction to Common Data Integration Approaches ; Meta Data - Types and Sources , Introduction to Data Quality, Data Profiling Concepts and Applications, Introduction to ETL using Kettle **(12)**

#### INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING

Introduction to Data and Dimension Modeling , Multidimensional Data Model ,ER Modeling vs. Multi Dimensional Modeling ,Concepts of Dimensions, Facts, Cubes, Attribute, Hierarchies, Star and Snowflakes Schema. Introduction to Business Metrics and KPIs, Creating Cubes using Microsoft Excel. **(10)**

#### BASICS OF ENTERPRISE REPORTING

A Typical Enterprise, Malcolm Bridge - Quality Performance Framework, Balanced Scorecard, Enterprise Dashboard, Balanced Scorecard vs. Enterprise Dashboard, Enterprise Reporting using MS Access / MS Excel, Best Practices in the Design of Enterprise Dashboards **(9)**

**TOTAL : 45**

## REFERENCES

1. *RN Prasad and Seema Acharya , "Fundamentals of Business Analytics", Wiley India, 2011.*
2. *David Loshin, "Business Intelligence", Elsevier Science and Technology, Second Edition, 2012.*
3. *Mike Biere, "Business Intelligence for the Enterprise", Pearson, 2010.*

# 15MCSEE06 - SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OBJECTIVE

To understand the key elements and attributes of Information technology projects, the various project management activities like scoping, planning, scheduling, monitoring and controlling and the use of various project management tools and techniques.

### COURSE OUTCOME

- CO1** : Ability to perform project scoping, estimating and scheduling of the various project management activities.
- CO2** : Ability to monitor, control the project progress and manage changes and Risks using appropriate tools and techniques.
- CO3** : Understand the project cost management principles and the use of cost control methods.
- CO4** : Understanding the Quality and Human Resource management issues in ensuring project success

## INTRODUCTION TO PROJECT MANAGEMENT

**Introduction to Project Management** : Project attributes-constraints- Project stakeholders-Project Management knowledge areas- Project management tools and techniques- The Role of the Project Manager - PMI, Certification, ethics in project management, Project Manager Job description and Skills.

**Understanding organizations** : Four frames of organization-organization structure & culture.

**Recent Trends Affecting IT Project Management** : globalization-outsourcing-virtual teams and Agile project management. **(6)**

## PROJECT INTEGRATION & SCOPE MANAGEMENT

**Project Integration Management** : Main processes- Developing a Project Charter-Developing Project Management Plans and its contents-Project execution tools and techniques- Monitoring and Controlling Project Work - Integrated Change Control- Closing Projects.

**Project scope management** : Main processes of Scope Management- scope management plan - Collecting requirements - Defining Scope - work breakdown structure -WBS dictionary- Scope validation and scope control. **(9)**

## PROJECT TIME & COST MANAGEMENT

**Project time management** : Importance of project schedules - Planning project schedule- Defining and Sequencing Activities - Estimating Activity Resources and Duration. Developing Schedule: Gantt charts, Critical Path Method and calculating the critical path- PERT - Controlling the Schedule and use of Software for Project Time Management.

**Project cost management** : Processes-Basic principles of cost management - Planning cost management -Types of cost estimates-cost estimation tools and techniques-Problems in cost estimation-LOC- Function points-COCOMO- Determining the budget-Cost control: Earned Value Management. **(11)**

## **PROJECT HUMAN RESOURCE & COMMUNICATION MANAGEMENT**

**Project human resource management** : HR management Processes-Motivation theories-Maslow's hierarchy needs-Herzberg' theory-Developing the Human Resource Plan-project organizational chart-responsibility assignment matrices -Developing the project team- training -team building-rewards & recognitions- Tools and techniques for managing project teams. Project Communication management: Keys to good communications- Planning Communication management - managing & improving project communications. **(6)**

## **PROJECT RISK & QUALITY MANAGEMENT**

**Project Risk Management** : Major processes in risk management-planning risk management - common sources of risk IT projects - identifying risks - performing qualitative risk analysis - performing quantitative risk analysis - planning risk responses- controlling risks.

**Project Quality Management** : Main processes-importance- Planning Quality Management - Performing Quality Assurance - Controlling Quality - Tools and techniques for quality control-concepts of Six Sigma-Cost of quality. **(9)**

## **PROJECT IMPLEMENTATION & CLOSURE**

**Project implementation** : Direct cutover-Parallel-Phased implementation. Administrative closure: Project sponsor acceptance-Final Project Report & Presentation-Closing the project. Project Evaluation: Performance review-Postmortem- Project audit. **(4)**

**TOTAL : 45**

## **REFERENCES**

1. *Kathy Schwalbe, "Information Technology Project Management", Cengage Learning India Private Limited, New Delhi, seventh Edition, 2014.*
2. *Jack T.Marchewka, "Information Technology Project Management", Wiley India, Fifth Edition,2015.*
3. *Subramaniam Chandramouli, Saikat Dutt, "Software Project Management", Pearson Education, First Edition, 2015.*

# **COIMBATORE INSTITUTE OF TECHNOLOGY**

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**DIAMOND JUBILEE**

(1956 - 2016)



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**M.E. COMPUTER SCIENCE AND ENGINEERING**

**CURRICULUM AND SYLLABI**

**UNDER CHOICE BASED CREDIT SYSTEM**

(For the students admitted during the academic year 2015-2016 and onwards)

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