CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION

M.TECH (CSE) – REGULAR (CBCS)

I- SEMESTER

Course Code	Course	No. of Hrs./Week		Marks for		Total Marks	Credits
		L	T/P/S	Internal Assessment	End Exam		
16CSC101	Advanced Algorithms	3	1	30	70	100	4
16CSC102	Advanced Operating Systems	3	1	30	70	100	4
16CSC103	Advanced Databases	3	1	30	70	100	4
16CSE11X	Elective 1	3	--	30	70	100	3
16CSE12X	Elective 2	3	--	30	70	100	3
16CSE13X	Elective 3	3	--	30	70	100	3
16CSC104	ADB Lab (Lab-I)	---	3	50	-	50	2
16CSC105	Seminar - I	---	3	50	-	50	2
16EG104	*Soft Skills Lab	---	2	* Non-Credits			
Total		18	11	280	420	700	25

* L: Lecture T: Tutorial P: Practical

II-SEMESTER

Course Code	Course	No. of Hrs./Week		Marks for		Total Marks	Credits
		L	T/P/S	Internal Assessment	End Exam		
16CSC201	Advanced Network Technologies	3	1	30	70	100	4
16CSC202	Big Data Analytics	3	1	30	70	100	4
16CSC203	Advanced Software Engineering	3	1	30	70	100	4
16CSE24X	Elective 4	3	---	30	70	100	3
16CSE25X	Elective 5	3	---	30	70	100	3
16CSE26X	Elective 6	3	---	30	70	100	3
16CSC204	Big Data Analytics Lab (Lab-II)	---	3	50	-	50	2
16CSC205	Seminar - II	---	3	50	-	50	2
16CSC206	Mini Project		2	50	-	50	1
Total		18	11	330	420	750	26

LIST OF ELECTIVES COURSES

ELECTIVE – I		ELECTIVE - II	
16CSE111	Data Mining	16CSE121	Internet of Things
16CSE112	Artificial Intelligence	16CSE122	Research Methodologies in Computer Science
16CSE113	Machine Learning	16CSE123	Business Intelligence
ELECTIVE – III		**ELECTIVE – IV**	
16CSE131	Software Quality Assurance & Testing	16CSE241	Ad hoc and Sensor Networks
16CSE132	Mobile Computing	16CSE242	Embedded Systems
16CSE133	Natural Language Processing	16CSE243	Image Processing
ELECTIVE – V		**ELECTIVE – VI**	
16CSE251	Cloud Computing	16CSE261	Software Reuse Techniques
16CSE252	Soft Computing	16CSE262	Storage Management
16CSE253	High Performance Systems	16CSE263	Streaming Technology

III-SEMESTER

Course Code	Course		Marks for		Total Marks	Credits
			Internal Assessment	End Exam		
	Project Seminar	I. Problem formulation and submission of synopsis within 8 weeks from the commencement of 3rd semester. ----------**(50 Marks)** II. Preliminary work on Project Implementation.--------**(50 Marks)**	100	----	100	6
Total			100		100	6

IV-SEMESTER

Course Code	Course	Marks for		Total Marks	Credits
		Internal Assessment	End Exam		
	Project Work and Dissertation	100	100	200	12
Total				200	12

Detailed Syllabus

Course Code: 16CSC101

ADVANCED ALGORITHMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Develop mathematical skills for algorithm design, analysis, evaluation and computational cost
2. Develop the skills to design and implement efficient programming solutions to various problems
3. Develop data structure techniques for various aspects of programming

Course Outcomes:

After completion of this course, the student will be able to

1. Design, analyze and evaluate algorithms
2. Develop the skills to design and implement efficient programming solutions to various problems
3. Use data structure techniques for various aspects of programming
4. Gains knowledge in text processing, security algorithms and computational geometry.
5. Design algorithms for real time problems.

UNIT- I

Algorithm Analysis: Asymptotic Notation, Amortization, Basic Data Structure: Stacks and Queues, Vectors, Lists and Sequences, Trees, Priority Queues, Heaps, Dictionaries and Hash Tables ,Search Trees and Skip Lists: Ordered Dictionaries and binary Search Trees, AVL trees, Bounded-Depth Search Trees.

UNIT-II

Fundamental Techniques: The Greedy Method, Divide and Conquer, Dynamic Programming, Graphs: The Graph abstract data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT-III

Weighted Graphs: Single Source Shortest Paths, All pairs Shortest Paths, Minimum Spanning Trees. Network Flow and Matching: Flows and Cuts, Maximum Flow, Maximum Bipartite Matching, Minimum Cost Flow

UNIT-IV

Text processing: Strings and Pattern Matching algorithms, Tries, Text Compression, Text Similarity testing. Number Theory and Cryptography: Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

UNIT-V

Computational Geometry: Range Trees, Priority Search Trees, Quad trees and k-d Trees, Convex Hulls, N-P Complete.

Suggested Reading:

1. M.T.Goodrich, R.Tomassia, "**Algorithm design – Foundations, Analysis, and Internet Algorithms**", John Wiley, 2002
2. E Horrowitz, S salmi, S Rajasekaran, "**Fundamentals of Computer Algorithms**", Second Edition, University Press, 2007

Reference Books:

1. Aho, A V Hopcraft Ullman JD, "**The Design and analysis of computer Algorithms**", Pearson Education, 2007
2. Hari Mohan Pandy, " **Design analysis amd Algorithms**", University Science press, 2009
3. Cormen, Lieserson, Rivest, "**Introduction to Algorithms**", 2nd Edition, PHI, 2003

Course Code: 16CSC102

ADVANCED OPERATING SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Understand global view of distributed operating systems and provides theoretical foundation for distributed systems.
2. Study the characteristics of OS for Multiprocessor and Multicomputer.
3. Learn the issues related to designing OS.
4. Understand Security & protection in computer systems and mechanisms used in building multiprocessor operating systems.
5. Explore management of different resources in distributed systems.

Course Outcomes:

After completion of this course, the student will have

1. Knowledge about advanced concepts in OS
2. Ability to develop OS for distributed systems
3. Ability to implement protection and security for distributed systems
4. Ability to develop Fault tolerant systems
5. Ability to develop multiprocessor operating systems
6. Ability to develop modules for Real time operating systems

UNIT- I

Overview of Advanced O.S: Design approaches, Motivation, Types of Advanced OS.
Architecture: Motivations, System Architecture types, Issues in Distributed Operating system.
Theoretical Foundations: Limitations, Lamport's logical clock, vector Clocks, Global state, Cuts, Termination Detection.

UNIT- II

Distributed Mutual Exclusion: Classificaton, Requirements, Performance, Simple Solution, Non-token-based Algorithms- Lamport's Algorithm, Recart-agrawala Algorithm, Token-based Algorithms - Suzuki-kasami's broadcast algorithm, Singhal's Heuristic Algorithm.
Distributed Deadlock Detection: Resource Vs. Communication Deadlocks, Graph-Theoretic model Strategies to handle Deadlocks, Issues in Deadlock detection and Resolution, Control organizations, Centralized Deadlock detection Algorithms- Completely centralized, Ho-Ramamoorthy Algorithms, Distributed Deadlock detection Algorithms - Path-Pushing, Edge-Chasing Algorithms. Hierarchical Deadlock detection Algorithms – Menasce - Muntz, Ho-Ramamoorthy Algorithm.
Agreement Protocols: System model, Classification of agreement problems, Solutions to Byzantine agreement problems.

UNIT- III

Distributed File Systems: Mechanisms for building DFSs, Design Issues, Case studies - Sun NFS, and Sprite File System.
Distributed Shared Memory: Algorithms for implementing DSMs, Memory Coherence, and Coherence Protocols, Design Issues, Case Studies - IVY.

Distributed Scheduling: Issues in Load Distribution, Components of a load distribution algorithm, Stability, Load Distributing Algorithms, Performance. Task migration.

UNIT- IV

Recovery: Classification of failures, backward and Forward Error Recovery. Backward Error Recovery, Recovery in concurrent systems, Consistent set of Checkpoints Synchronous and Asynchronous Check pointing and Recovery.

Protection and Security: Access Matrix Model, Implementation of access matrix, Introduction to Data Security. Private Key, Public key, Kerberos System.

UNIT- V

Multiprocessor Operating System: Motivation, Basic Multiprocessor System Architecture, Interconnection Networks for Multiprocessor System, caching, Hypercube Architecture. Threads, Process Synchronization, Processor Scheduling, memory management

Real Time Operating System : Fundamentals, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization.

Suggested Reading:

1. M Singhal and NG Shivaratri , "**Advanced Concepts in Operating Systems**", Tata McGraw Hill Inc, 2001

Reference Books:

1. A S Tanenbaum, "**Distributed Operating Systems**", Pearson Education Asia, 2001
2. Pradeep K. Sinha, "**Distributed operating system concepts & Design**", PHI,2003

Course Code: 16CSC103

ADVANCED DATABASES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Design high-quality relational databases and database applications.
2. Translate complex conceptual data models into logical and physical database designs.
3. Gain an understanding of Oracle11g and XML
4. Have a outline knowledge about Parallel and Distributed Databases 5. Gain experience in Performance Tuning

Course Outcomes:

After completion of this course, the student will be able to

1. Analyze and evaluate modeling and development methods/techniques in Object-based Databases
2. Understand and analyze query processing and optimization.
3. Understand how distributed and parallel databases are implemented, and how applications can be designed for those databases.
4. Gain insight into some advanced topics in database such as Performance Tuning, spatial databases, temporal databases.
5. Understand and implement cloud-based databases
6. Develop applications for mobility and personal databases.

UNIT- I

Object Based Databases: Overview, complex Data Types, Structured Types and Inheritance in SL, table Inheritance, Array and Multiset Types in SQL, Object –Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object- Relational Mapping, Object – Oriented versus Object-Relational.

UNIT-II

XML: Motivation, Structure of XML data, XML Document schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT-III

Query processing:

Overview, Measures of Query Cost, Selection operating, sorting, Join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expressing Results, Choice of Evaluation plans, Materialized Views.

UNIT-IV

Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Interoperation Parallelism Query Optimization, Design of Parallel Systems.

Distributed Databases: Homogenous and Heterogeneous Databases, distributed data storage, Distributed Transactions, Commit Protocols, concurrency Control in Distributed Databases,

Availability, Distributed Query Processing, Heterogeneous Distributed Databases, cloud Based Databases, Directory systems.

UNIT-V

Advanced Application development: Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization

Spatial and Temporal Data and Mobility: Motivation, Time in Databases, spatial and Geographical Data, Multimedia Databases, Mobility and Personal databases

Suggested Reading:

1. Abraham Silbershatz, Henry F Korth, S Sudharshan, "**Database System Concepts**", McGraw Hill International Edition, Sixth Edition, 2010
2. Elmasri Navathe, Somayajulu, Gupta, " **Fundamentals of Database Systems**", Pearson Education, Fourth Edition, 2006.

Reference Books:

1. CJ Date, A Kannan, S Swamynathan, "**An Introduction to database Systems**", Pearson Education, Eight Edition, 2006
2. Ramakrishna, Gehrke, "**Database Management",** International Edition, Third Edition, 2003

Course Code: 16CSE111

DATA MINING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of this course are

1. To introduce the basic concepts of Data Mining, Challenges and Applications
2. To study various data mining algorithms
3. To discuss about the data mining algorithms solving real time problems.

Course Outcomes:

After completion of this course, the student will be able to

1. Understand basic concepts related to Data mining, data quality and metrics
2. Identify the applications of Data Mining
3. Identify an understand working of various Data Mining Techniques
4. Apply Data Mining Techniques to solve real world problems
5. Analyze the complexity, limitation of application of various Data Mining algorithms
6. Evaluate various Data mining Technologies

UNIT - I

Introduction: Challenges, Origins of Data Mining and Data Mining Tasks. Data**:** Types of Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, OLAP and Multidimensional Data Analysis.

UNIT - II

Classification: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction-Model Over fitting, evaluating the Performance of a Classifier, Rule-Based Classifier.

UNIT - III

Classification: Nearest-Neighbor classifiers, Bayesian Classifiers, Artificial Neutral Networks, Support Vector Machine, Ensemble Methods, Class Imbalance Problem, Multiclass Problem.

UNIT - IV

Association Analysis: Problem Definition, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets, Alternative Methods for Generating Frequent Item Sets, FP-Growth Algorithm, Evaluation of Association Patterns, Effect of Skewed Support Distribution.

UNIT - V

Cluster Analysis: Overview, K-means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation on Characteristics of Data, Clusters and Clustering Algorithms.

Suggested Reading:

1. Pang-Ning Tan. Michael Steinbach, Vipin Kumar, "**Introduction to Data Mining**", Pearson Education, 2008.
2. K.p.Soman, ShyamDiwakar, V.ajay, "**Insight into data Mining theory and Practice**", PHI, 2010

Reference Books:

1. Arun K Pujari, "**Data Mining Techniques**", University Press. 2nd Edn, 2009.
2. Vikrarm Pudi, P. Radha Krishna, "**Data Mining**", Oxford University Press, 1st edition, 2009.
3. Sumathi, S N Sivanandam, "**Introduction to Data Mining and its Applications** ", Springer.

Course Code: 16CSE112

ARTIFICIAL INTELLIGENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should will have

1. The basic principles of Artificial Intelligence.
2. Various knowledge representation schemes in Artificial Intelligence
3. The concepts needed to build an Artificial Intelligence systems: logic programming, probability, Learning and Artificial Neural Networks.

Course Outcomes:

Upon successful completion, students can comprehend

1. Describes the Basics components and major techniques behind Artificial Intelligence Systems.
2. Understands the Knowledge formulations representation, reasoning techniques and semantic tableau systems.
3. Understands architecture of an experts system, tools and applying uncertainty measures to solve real world problems
4. Analyzes machine learning paradigms, various learning strategies and understands the differentiate learning strategies
5. Exposure to various artificial neural networks and its functionality.
6. The concepts needed to build an Artificial Intelligence Systems advanced knowledge representation techniques and fundamentals of Natural language processing.

UNIT-I

Introduction: History, Intelligent Systems, Foundations of AI, Subareas of AI, Applications
Problem Solving-State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction.
Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.

UNIT -II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT -III

Expert System and Applications: Introduction, Phasesin Building Expert Systems, Expert System Architecture, Expert Systems versus Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, Use of Shells and Tools
Uncertainty Measure-Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory

UNIT –IV

Machine-Learning Paradigms: Introduction. Machine Learning Systems. Supervised and Unsupervised Learning. Inductive Learning. Learning Decision Trees(SuggestedReading2), Deductive Learning. Clustering, Support Vector Machines.

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-LayerFeed-Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks

UNIT -V

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web

Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Suggested Reading:

1. Saroj Kaushik."**Artificial Intelligence**", Cengage Learning. 2011.
2. Russell, Norvig, "**Artificial intelligence, A Modern Approach"**, Pearson Education, Second Edition2004.

Reference Books:

1. Rich, Knight, Nair, "**Artificial intelligence**", Tata McGraw Hill, Third Edition 2009.

Course Code: 16CSE113

MACHINE LEARNING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The main objectives of this course are

1. To discuss basic concepts of Machine Learning, problems and the other concepts such a algorithms, heuristics, solution spaces and relate them to brute force searching.
2. To study mathematical concepts related to the machine learning algorithms.
3. To demonstrate familiarity with various techniques in Machine Learning techniques and their applications as well as general questions related to analyzing and handling large data sets.

Course Outcomes:

Upon successful completion of the course, student

1. Acquire the basic knowledge of Machine Learning, identify algorithms, machine learning problems
2. Gets ability to apply the knowledge of computing and mathematics appropriate to the discipline
3. Identifies various machine learning techniques such as decision tree, artificial neural networks, Bayesian learning, genetic algorithms, clustering and classification algorithms etc. and their applications.
4. Gets working knowledge of applying the ML algorithms to the available large data sets with the available simulation packages such as WEKA , Clementine etc.
5. Analyze the Machine Learning algorithms
6. Evaluate various Machine Learning Algorithms

UNIT-I

Introduction: Learning, Types of Machine Learning.

Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. Learning with Trees: Constructing Decision Trees, CART, Classification Example.

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability. Linear Regression Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back, Propagation Support Vector Machines: Optimal Separation, Kernels.

UNIT-III

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian. The Bias-Variance Tradeoff, Bayesian learning: Introduction, Bayes theorem, Bayes Optimal Classifier, Naive Bayes Classifier.

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators. Genetic Programming Ensemble learning: Boosting, Bagging.

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT-V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

Suggested Reading*:*

1. Tom M. Mitchell, "**Machine Learning** ",MacGraw Hill, 1997.
2. Stephen Marsland, "**Machine Learning - An Algorithmic Perspective** ", CRC Press, 2009.

Reference Books:

1. Margaret H Dunham, "**Data Mining**", Pearson Edition, 2003.
2. GalitShmueli, Nitin R Patel, Peter C Bruce, "**Data Mining for Business Intelligence**", Wiley India Edition, 2007.
3. RajjallShinghal, "**Pattern Recognition** ", Oxford University Press, 2006.

Course Code: 16CSE121

INTERNET OF THINGS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should

1. Understand vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Explore Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Explore the Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Building state of the art architecture in IoT.
5. Understand Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

UNIT-I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT-II

M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. **M2M to IoT-An Architectural Overview**– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT-III

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT-IV

IoT Architecture-State of the Art – Introduction, State of the art,**Architecture Reference Model-** Introduction, Reference Model and architecture, IoT reference Model

UNIT-V

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.**Industrial Automation-** Service-oriented

architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things,**Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Suggested Reading:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**", 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "**Internet of Things (A Hands-on-Approach)**", 1stEdition, VPT, 2014.
2. Francis daCosta, "**Rethinking the Internet of Things: A Scalable Approach to Connecting Everything**", 1st Edition, Apress Publications, 2013

Course Code: 16CSE122

RESEARCH METHODOLOGIES IN COMPUTER SCIENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should

1. Understand epistemology, objectives and types of research.
2. Collect data, analyze and report the results.
3. Apply latest computer methodologies to the research problems.

Course Outcomes

Upon the successful completion of the course student will be able to

1. Identify design and formulate a research problem
2. Explore different data collection methods and analyze data
3. Use different CI methodologies to solve a problem.
4. Test, Analyze and interpret the data.
5. Write a report of the findings of research problems.

UNIT- I

Introduction to Research Methods**:**, Evolutionary Epistemology, Scientific Methods, Hypotheses Generation and Evaluation, Code of Research Ethics, Issues related to plagiarism, collaborative models and ethics, acknowledgments. Intellectual Property Rights: Copy rights, copy left, Patents, Industrial designs, Trademarks. Definition and Objectives of Research, Various Steps in Scientific Research, Types of Research, Research Purposes, Research Design, Survey Research, Case Study Research.

UNIT- II

Data: Methods of Data collection, Description and Analysis of Data, Sampling Design, Role of Statistics for Data Analysis, Functions of Statistics, Estimates of Population, Parameters, Parametric V/s Non Parametric methods, Descriptive Statistics, Points of Central tendency, Measures of Variability, Measures of relationship, Inferential Statistics- Estimation, Hypotheses Testing.

UNIT-III

Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance, Chi-square, t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Correlation and Regression.

Computational Intelligence: Computational Intelligence Paradigms, Artificial Neural Networks, Evolutionary Computation, Swarm Intelligence, Artificial Immune Systems, Fuzzy Systems.

Epistemology: applications in AI, Software Engineering

UNIT-V

Research Reports, Ethics and Morals: Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report. Format of the

Research Report, Style of writing report, References / Bibliography / Webilography. Technical paper writing / Journal report writing, Writing Research Grant Proposal, Funding agencies

Suggested Reading:

1. C.R.Kothari, "**Research Methodology, Methods and Techniques"**, New age International Publishers, 2004
2. Andries P. Engelbrecht, "**Computational Intelligence An Introduction**", Wiley, 2nd Edition, 2007

Reference Books:

1. Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, "**Understanding Big Data Analytics for Enterprise class Hadoop and Streaming Data**" I Edition, TMH 2012.
2. R.Ganesan, "**Research Methodology for Engineers**", MJP Publishers, 2011
3. Y.P.Agarwal, "**Statistical Methods: Concepts, Application and Computation**", Sterling Publications Pvt.Ltd., New Delhi, 2004.
4. Vijay Upagade and Araving Shende, "**Research Methodology**", S.Chand & Company Ltd. New Delhi, 2009.
5. **Statistical Methods** by S.P.Gupta.

Course Code: 16CSE123

BUSINESS INTELLIGENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course, student

1. Gets familiarized with Business Intelligence methodologies
2. Learns data warehousing concepts
3. Get familiarized with business management
4. Learns data mining concepts and implementation of business intelligence

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand concepts of Data warehousing and data mining
2. Explore different changing scenarios in business intelligence
3. Learn analysis and reporting with available Business Intelligence software
4. Apply various data mining tool for Business Intelligence
5. Understand ethical and legal issues involved in Business Intelligence

UNIT- I

Introduction to Business Intelligence: Changing Business environments and computerized decision support, A framework for Business Intelligence, Intelligence creation and use in governance, transactional processing versus Analytical processing, successful Business Intelligence implementation, tools and techniques

UNIT -II

Data Warehousing: definition and concepts, DW process overview, Architectures, Data integration and extraction, transformation and load(ETL) processes, Implementation issues, Real time data warehousing.

UNIT -III

Business Reporting, Visual Analytics and Business Performance Management: Overview, strategies, performance measures, Methodologies, applications.

UNIT -IV

Data Mining for BI: Definitions, Methods, process, Text Mining: NLP, Text mining applications, process, tools, Web Mining: web mining process, methods.

UNIT -V

Business Intelligence implementation: Integration and emerging trends, issues of legality, ethics.

Suggested Reading:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, Janine E. Aronson."**Business Intelligence**(2nd Edition)Paperback, 312 Pages, Published 2010 by Prentice Hall
2. David Loshin, "**Business Intelligence"** - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.

Course Code: 16CSE131

SOFTWARE QUALITY ASSURANCE AND TESTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course, student

1. Learns the importance of software quality assurance.
2. Gets knowledge about Quality tools in the Software development process.
3. Gains an insight to Software Testing.

Course Outcomes:

Upon successful completion of the course students would have

1. Gained Knowledge about Software Quality assurance.
2. Acquainted with various Quality tools.
3. Gained knowledge about Software Testing.
4. Learned techniques to improve the quality of their own software development.
5. Prepared a software quality plan for a software project.

UNIT-I

Software Quality, Quality Management, Software Quality Metrics, Product Quality Metrics, Process Quality Maintenance, Examples.

UNIT-II

Quality Too1s in Software Development, Seven Basic Tools, Check List, Pareto Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause and Effect Diagram, Defect Removal, Effect Removal Effectiveness, Quality Planning, Cost Effectiveness of Phase Effect Removal.

UNIT-III

Software Testing Background, Software Development Process, Realities of Software Testing, Examining the Specification, Testing the s/w with Blinders on Examining the Code, Testing the s/ w with X-ray.

UNIT-IV

Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Website Testing, Automated Testing and Test Tools Bug Bashes & Beta Testing.

UNIT-V

Planning Your Test Effort, Writing & Tracking Test Cases, Reporting Measuring SQA.

Suggested Reading:

1. Stepen. H. Khan, "**Metrics and Models in Software Quality Engineering**", Pearson Education. India, 1995.
2. Ron Patton, "**Software Testing**", Sams Publishing, 2001.

Reference Books:

1. Boris Beizzer, "**Software Testing Techniques**" Sams Publishing, 2001.
2. Allan Gilles, "**Software Quality Theory & Management**", Thomson International Press, 1997.

Course Code: 16CSE132

MOBILE COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should

1. Understands the basic concepts and principles in mobile computing.
2. Gets involved, in networks & systems issues for the design and implementation of mobile computing systems and applications.
3. Understands the key components and technologies involved and to gain hands on experiences in building mobile applications.

Course Outcomes:

After completion of this course, the student will be able to

1. Explain state-of-the-art wireless technologies.
2. Describe the functional architecture of Telecommunication Systems and Broad cast systems.
3. Distinguish various IEEE 802.11 standards of technologies in WLAN
4. Explain the various routing algorithms used in Adhoc-Networks and discuss their pros and cons.
5. Describe the publishing and accessing data and data delivery models and distributed file sharing Techniques and mobile Transaction models.

UNIT-I

Introduction: Wireless transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC SDMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, RA, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11, Architecture, Services, MAC-Physical Layer, IEEE 802.11a-802.11b Standards, Bluetooth.

UNIT-IV

Routing Adhoc Network Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, fish-eye state routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm.

Mobile IP- Dynamic Host Configuration Protocol.

Traditional TCP-Classical TCP Improvements-WAP, WAP 2.0

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing Scheme for Push Based Data Delivery.

File System Support for Mobility: Distributed File sharing for Mobility Support, Coda and other Storage Manager for Mobility Support.
Mobile Transaction and Commerce: Models for Mobile transaction, Kangaroo and Joey Transactions, Team Transaction. Recovery Model for Mobile Transactions. Electronic Payment and Protocols for Mobile Commerce.

Suggested Reading:

1. Jochen, M Schiller, "**Mobile Communications**", 2nd Edition Pearson Education, India, 2009.
2. Kurnkum Garg "**Mobile Computing**", Pearson 2010.

Reference Books:

1. Asoke K Talukder,Roopa R Yavagal, "**Mobile Computing**", TMH 2008.
2. Raj Kamal,"**Mobile Computing**", Oxford, 2009.

Course Code: 16CSE133

NATURAL LANGUAGE PROCESSING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of this course are to:

1. Teach students the leading trends and systems in natural language processing
2. Make the students for understanding the concepts of morphology, syntax, semantics and pragmatics of the language
3. Teach the students for recognizing the significance of pragmatics for natural language understanding and structures.
4. Teach the students at least two methods of handling the pronoun relations and Information retrieval basics with the purpose of understanding the semantic interpretation.

Course Outcomes:

Upon successful completion of the students will be able to:

1. Understand the basics of terms like words and words forms of natural language processing and also the concepts of morphology, syntax, semantics and pragmatics of the language.
2. Recognize the significance of structures of the language and demonstrate the difference between the different parsing and ambiguity resolutions.
3. Describe them capable to describe the application based on natural language processing and to show the points of lexical syntactic, semantic and pragmatic processing.
4. Understand the basics of information retrieval and lexical resources and handling the pronoun relations, tagging, word net etc,.
5. Understand the applications of NLP and semantic issues.

UNIT - I

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

UNIT - II

Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

UNIT - III

Meaning: Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

UNIT - IV

Information Retrieval and Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger-Research Corpora.

UNIT - V

Applications of NLP: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

Suggested Reading:

1. Jurafsky, Dan and Martin, James, "**Speech and Language Processing"**, Second Edition, Prentice Hall, 2008.

Reference Books:

1. L. Allen, James, "**Natural Language Understanding"**, Second Edition, Benjamin/Cumming, L995.
2. M. Charniack, Eugene, "**Statistical Language Learning**", MIT Press, L99H.
3. H. Jurafsky, Dan and Martin, James," **Speech and Language Processing**", Second Edition, Prentice Hall, M008.
4. Manning, Christopher and Heinrich, Schutze, "**Foundations of Statistical Natural Language Processing**", MIT Press, L999.
5. "**Natural Language Processing and Text Mining**", Kao, Springer, ISBN-978L846M8L75

Course Code: 16CSC201

ADVANCED NETWORK TECHNOLOGIES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of this course are:

1. To expose the students with advanced network concepts such as wireless MAC, BGP routing, MPLS, QOS scheduling and flow control, TCP variants etc.
2. To understand further details of computer networks
3. To focus on teaching research methods such as simulations and performance evaluation through assignments, projects and visits

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Recollect the fundamental knowledge in computer networks
2. Identify and understand the advanced network concepts
3. Distinguish different flow control protocols
4. Identify, install and use network simulators
5. Conduct experiments to measure and analyze network performance
6. Investigate and review the network issues

UNIT-I:

Review of the Internet architecture, layering; wired and wireless MAC;

UNIT-II:

Intra- and inter-domain Internet routing, BGP, MPLS, MANETs;

UNIT-III:

Error control and reliable delivery, ARQ, FEC, TCP; congestion and flow control; QoS, scheduling;

UNIT-IV:

Mobility, mobile IP, TCP and MAC interactions, session persistence; multicast;

UNIT-V:

Internet topology, economic models of ISPs/CDNs/content providers; future directions

Suggested Reading:

1. Keshav, S. "**An Engineering Approach to Computer Networks**", Addition Wesley Professional.
2. Shivkumar, "**Network Architecture: Principles, Guidelines**", RPI 2006.
3. Peterson and Davie (book), "**Computer Networks: A Systems Approach"**
4. Relevant papers

Reference Books:

1. William Stallings, "**Data and Computer Communications"**, 7th edition, Prentice Hall, 2004.
2. Andrew S. Tanenbaum, "**Computer Networks**", 4th edition, Prentice-Hall, Inc., 2003.
3. Larry L. Peterson and Bruce S. Davie, "**Computer Networks: A Systems Approach**", 3rd edition (2003), Morgan Kaufmann Publishers.

Course Code: 16CSC202

BIG DATA ANALYTICS

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of this course, students should be able to

1. Applying and understanding the big data flow for the actual projects.
2. Understands the lifecycle of the data analytics & big data ecosystem.
3. Implement the exploring and analysis of big data on a real world problem.
4. Acquires knowledge on the tools and techniques for solving big data analytics.
5. Aearns how to applying the mining techniques on big data.
6. Understand the Hadoop ecosystem.

Course Outcomes:

Upon successful completion of the course, students will

1. Have a clear idea about the big data flow and its ecosystem.
2. Be capable enough to apply the tools and techniques on big data.
3. Be able to apply data mining techniques for solving big data problems.
4. Be skilled to use the statistical tool and statistical methods that can be applied on big data.
5. Have a clear idea about how to represent the unstructured data in the data bases.
6. Grasp the Hadoop ecosystem.

UNIT-1

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics

Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA)

Review of Basic Data Analytic Methods Using R: Introduction to R, Exploratory Data Analysis, Statistical Methods for Evaluation

UNIT-II

Advanced Analytical Theory and Methods- Clustering: Overview of Clustering, K-means, Additional Algorithms

Advanced Analytical Theory and Methods-Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, Validation and Testing , Diagnostics

UNIT-III

Advanced Analytical Theory and Methods- Regression : Linear Regression, Logistic Regression, Reasons to Choose and Cautions, Additional Regression Models

Advanced Analytical Theory and Methods-Classification: Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods

UNIT-IV

Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods

Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps , A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency--Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights

UNIT-V

Advanced Analytics: Technology and Tools-MapReduce and Hadoop: Analytics for Unstructured Data, The Hadoop Ecosystem, NoSQL

Advanced Analytics: Technology and Tools-In-Database Analytics: SQL Essentials, In-Database Text Analysis, Advanced SQL

The Endgame or Putting It All Together: Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics

Suggested Reading:

1. EMC Education Services "**Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data**" Wiley Publishers
2. Michael Berthold, David J. Hand, "**Intelligent Data Analysis**", Springer, 2007.
3. Tom White " **Hadoop: The Definitive Guide**" Third Edition, Oreilly Media, 2011
4. Prajapati, V. "**Big data analytics with R and Hadoop"**. Packt Publishing Ltd, 2013

Reference Books:

1. Frank J. Ohlhorst, "**Big Data Analytics: Turning Big Data into Big Money**", Wiley Publishers
2. Tom Plunkett, Mark Hornick, "**Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop**", McGraw-Hill/Osborne Media (2013), Oracle press.
3. AnandRajaraman and Jeffrey David Ullman, "**Mining of Massive Datasets**", Cambridge University Press, 2012.
4. Glenn J. Myatt, "**Making Sense of Data**", John Wiley & Sons, 2007 5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

Course Code: 16CSC203

ADVANCED SOFTWARE ENGINEERING

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of this course are

1. To familiarize students with software development process.
2. To learn software quality assessment.
3. To learn testing for optimum functionality at reasonable cost.
4. To understand the merits and demerits of different approaches in software engineering

Course Outcomes:

After completion of this course, student will be able to

1. Analyze various software engineering models and patterns generally used.
2. Choose the best model for the project based on the type of project.
3. Perform quality assessment testing on the software and measure the quality using various metrics.
4. Perform testing through various techniques to make sure the software project is optimal and to achieve this at a reasonable cost.
5. Design and conduct experiments, as well as to analyze and interpret data

UNIT-I

Introduction To Sotware Engineering: Software, What Is Software Engineering, Evolution Of Software Engineering Methodologies, Software Engineering Challenges, Software Engineering Principles, Software Process, Process Classification, Phase Development Life Cycle, Software Development Process Models.

UNIT-II

Software Project Management: Project Management Essentials, What Is Project Management, Project Life Cycle, Risk Management, Project Planning Estimation, Projects Planning Activities, Software Metrics And Measurement, Project Size Estimation, Staffing And Personnel Planning, Project Scheduling And Milestones.

Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirement Elicitation, Requirement Analysis, Structured Analysis, Data Oriented Analysis, Object Oriented Analysis, Requirements Specification, Requirements Validation.

UNIT-III

Software Design: Software Design Process, Characteristics Of A Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies.

Object Oriented Design Using UML: Object Oriented And Analysis And Design, Object Oriented And Concepts, Unified Modeling Language (Uml), Object Relationships, Uml Building Blocks, Uml Diagrams.

UNIT-IV

Implementation: Coding Principles, Coding Styles, Coding Process, Code Verification, Code Documentation, Software Testing, Testing Fundamentals, Test Planning, Blackbox Testing, White Box Testing, Levels Of Testing, Usability Testing, Regression Testing, Smoke Testing, Debugging Approaches.

Software Quality And Reliability: Software Quality Concept, Software Quality Factors, Verification And Validation, The Cost Of Quality, Software Quality Assurance, Quality Control, The ISO Quality Standard, The Capability Maturity Model, Six Sigma, Software Reliability, Reliability Growth Model.

UNIT-V

Software Maintenance: Software Change, Software Evolution, Software Maintenance, Maintenance Process Models, Maintenance Cost, What Is Reengineering, Reengineering Activities.

Suggested Reading:

1. Ugrasen Suman "**Software Engineering concepts and Practices**", Cengage Learning, 2013

Reference Books:

1. Roger S. Pressman, "**Software Engineering – A Practitioners Approach**", 7 th Edition, Pearson Education, India, 2010.
2. Shari Lawrence Pfleeger, "**Software Engineering Theory and Practices**" 4th Edition - Pearson Education, India, 2011.

Course Code: 16CSE241

ADHOC AND SENSOR NETWORKS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The main objectives of this course are:

1. To impart knowledge about Adhoc networks, design and implementation issues and available solutions.
2. To impart knowledge of routing mechanisms and the approaches in Adhoc networks.
3. To provide knowledge of sensor networks and their characteristics.
4. To study the applications of sensor networks.

Course Outcomes:

After completion of the course, students will be able to:

1. Describe the unique issues in adhoc/sensor networks.
2. Understand current technological trends for the implementation and deployment of wireless adhoc/sensor networks.
3. Explain the challenges in designing MAC, routing and transport protocols for wireless adhoc sensor networks.
4. Gain knowledge on implementation of protocols on a sensor test bed network.
5. Explain the principles of mobile adhoc networks (MANETs)
6. Explain the principles and characteristics of wireless sensor networks (WSNs).

UNIT-I

Introduction to Adhoc networks, Wireless LANs, Wireless PANs, Wireless Mesh Networks, Topology Control in Wireless Adhoc Networks, Broadcasting and Activity Scheduling in Adhoc Networks, Location Discovery, Mobile Adhoc Networks (MANETs): Routing Technology for Dynamic Wireless Networking, Congestion Control in adhoc wireless networks.

UNIT-II

Introduction, Routing in Adhoc Networks, Broadcasting, Multicasting and Geocasting, Mobile Adhoc Networking with a View of 4G Wireless: Imperatives and Challenges, Off-the-Shelf Enables of Adhoc Networks, IEEE 802.11 in Adhoc Networks: Protocols, Performance and Open Issues.

UNIT-III

Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols, Cognitive Radio and Networks, TCP over Adhoc Networks, Energy-Efficient Communication in Adhoc Wireless Networks, Adhoc Networks Security, Self-Organized and Cooperative Adhoc Networking, Security in Adhoc and Sensor Networks.

UNIT-IV

Introduction to Sensor networks, Introduction and Overview of Wireless Sensor Networks: Applications of Wireless Sensor Networks, Examples of Category 1 WSN Applications, Basic Wireless Sensor Technology: Sensor Node Technology, Sensor Taxonomy, WSN Operating Environment, WSN Trends.

UNIT-V

Sensor Networks Design Considerations, Sensor Networks in Controlled Environment, Wireless Transmission Technology and Systems: Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study.

Integrating MANETs, WLANs and Cellular Networks, Networking Sensors: Unique features, Deployment of adhoc/sensor network, Sensor tasking and control, Transport layer and security protocols, Applications of Sensor Networks.

Suggested Reading:

1. C. Siva Ram Murthy & B. S. Manoj, "**Adhoc Wireless, Networks – Architecture and Protocols**", Prentice Hall, 2004.
2. Jagannathan Sarangapani, "**Wireless Adhoc and Sensor Networks: Protocols, Performance, and Control**", CRC Press, 2007.

Reference Books:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "**Adhoc and Sensor Networks : Theory and Applications**", Second Edition, World Scientific Publishers, 2011
2. Prasant Mohapatra and Sriramamurty, "**Adhoc Networks: Technologies and Protocols**", Springer International Edition, 2009
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, "**Wireless Sensor Networks"**, A John Wiley & Sons Inc. Publication, 2007

Course Code: 16CSE242

EMBEDDED SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The man objectives of this course are:

1. To study the principles and concepts of embedded systems architecture embedded development and design approaches.
2. To discuss about the operating systems of embedded systems and their characteristics.
3. To identify and discuss about the tools for embedded system development.
4. To study about the process of embedded product development.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the basics concepts related to embedded systems and challenges in embedded systems
2. Describe the architecture of embedded systems
3. Understand the embedded hardware design and development using embedded EDA tools
4. Write programs for embedded systems.
5. Identify the characteristics of embedded operating systems and analyze the performance of embedded systems
6. Understand the process of embedded product development

UNIT-I

Introduction to Embedded Systems: Characteristics and quality attributes of Embedded Systems, Challenges in Embedded System Design, Application and Domain specific Embedded Systems.

UNIT–II

Embedded System Architecture: Instruction Set Architecture. CISC and RISC instruction set architecture. Basic Embedded Processor/Microcontroller Architecture, CISE Examples Motorola (68HCI 1), RISC Example- ARM. DSP Processors. Harvard Architecture Microcontroller Example - PIC.

UNIT –III

Embedded Hardware Design and Development: VLSI and Integrated Circuit Design. EDA tools. usage of ED A tools and PCB layout.

Embedded firmware and Design and Development: Embedded Hardware Design Approaches and Development languages and Programming in Embedded in C.

UNIT -IV

Operating System for Embedded Systems: Real Time Operating Systems Based Embedded System Design, Introduction to Embedded, Systems Design with Micro C/OS- II and Vx Works. Performance Issues of an Embedded System: CPU Performance, Analysis and Optimization of CPU Power Consumption, Program. Execution Time. Energy and Power. Program Size.

UNIT-V

Embedded Systems Development Environment: IDE. Cross Compilation, Disassembler, Simulators, Emulators and Debugging. Target Hardware Debugging. Boundary Scan. Product Enclosure Design and Development Tools, Embedded Product Development Life Cycle-Different phases and Approaches of EDLC. Trends in Embedded Industry.

Suggested Reading:

1. Shibu K V "**Introduction to Embedded Systems**" . Tata McGraw HilI, 201O.
2. Raj Kamal, "**Embedded Systems Architecture; Programming & Design** ", Tata McGraw Hill. 2010.

Reference Books:

1. Dr K.V.K.K. Prasad, "**Embedded Real time Systems: Concepts, Design and Programming**", Dreamtech Press, 2004.

Course Code: 16CSE243

IMAGE PROCESSING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The main objectives of this course are:

1. To impart knowledge about the fundaments concepts of digital image processing.
2. To study various image transformation and enhancement techniques used in digital image processing.
3. To discuss about the image reformation, segmentation techniques used in digital image processing.
4. To study various image compression techniques.

Course Outcomes:

At the end of the course, students will be able to

1. Understand the fundamentals of digital image processing.
2. Gain knowledge about image transformation techniques used in Image processing
3. Understand various image enhancement techniques used in digital image processing.
4. Describe various image segmentation methods used in digital image processing.
5. Explain various compression techniques their application.
6. Describe the image restoration models.

UNIT-I

Image Formation and Description: Digital Image Representation - Elements of Visual Perception. Sampling & Quantization. Elements of Digital Image Processing Systems.

UNIT-II

Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D, DCI. Walsh, Hadamard Transforms.

UNIT-III

Image Enhancements and Segmentation : Histogram Modification. Image Smoothing - Image Smoothing - Image Sharpening, Thresholding. Edge Detection. Segmentation. Point and Region Dependent Techniques.

UNIT-IV

Image Encoding: Fidelity Criteria. Transform Compression. K- Fourier, DCT, Spatial Compression. Run length Coding. Huffman Coding, Contour Coding.

UNIT-V

Restoration: Restoration Models, Inverse Filtering, Least Squares Filtering, Recursive Filtering.

Suggested Reading:

1. Gonzalez R.D.. Woods R.E. "**Digita1 Image Processing**", Addison Wesley, 1992.
2. Rosenfeld A, Kak AC. "**Digita1 Picture Processing**", Vol. I & II Acad. Press. 2nd ed. 1982.

Reference Books:

1. Milan Sonka. Vaclav Hlavac, Roger Boyle, "**Image Processing and Analysis and Machine Vision**", 2nd Edition, Thomson Learning, 1999.

Course Code: 16CSE251

CLOUD COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of cloud computing are:

1. To impart the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they can adopt Cloud Computing services and tools in their real life scenarios.
3. To provide knowledge about security and privacy issues related to cloud computing environments.
4. To enable students explore cloud computing driven commercial systems such as Google App Engine, Microsoft Azure and Amazon Web Services and others.

Course Outcomes:

Upon successful completion of the course, student should be able to:

1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explain and characterize various cloud service models, cloud deployment models and explore virtualization techniques that serve in offering software, computation and storage services on the cloud.
3. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Analyze various cloud programming models and apply them to solve problems on the cloud.

UNIT-I

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT-II

Virtual Machines and Virtualization of Clusters and Data Centers: Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Case studies: Xen VMM, VMware, Microsoft Virtual Server

UNIT-III

Cloud platform architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platform, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT-IV

Cloud Security and Trust Management, Data Security in the Cloud : An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, CryptDb:Onion Encryption layers and Homomorphic Encryption, Format Preserving Encryption.
Trust, Reputation and Security Management.

UNIT-V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.
Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing, Mobile Internet Devices and the Cloud

Suggested Reading:

1. John W. Rittinghouse, "**Cloud Computing: Implementation, Management, and Security** ". James F. Ransome, CRC Press 2009.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, "**Distributed and Cloud Computing From Parallel Processing to the Internet of Things**", Elsevier, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski,"**Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing)"**, Wiley Publishing ©2011.

Web resources:

1. http://aws.amazon.com
2. http://code.google.com/appsengine
3. http://www.buyya.com/

Reference Books:

1. Raluca Ada Popa, Catherine M.S. Redfield, Nickolai Zeldovich, and Hari Balakrishnan, "**CryptDB: Protecting Confidentiality with encrypted Query Processing**"23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
2. "**A Fully Homomorhic Encryption Scheme**", Craig Gentry, September 2009.
3. David Marshall, Wade A. Reynolds, "**Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center**", Auerbach Publications, 2006.

Course Code: 16CSE252

SOFT COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course, student should

1. Identify and describe soft computing and their roles in building intelligent machines
2. Recognize the feasibility of applying a soft computing methodology for a particular problem
3. Develop a Neural network for the proposed model
4. Design a genetic algorithm and implement various genetic operators
5. Ability to incorporate Fuzzy Logic and developing Neuro-fuzzy systems.

Course Outcomes:

Upon successful completion of the course, should be able to

1. Evaluate and compare solutions by various soft computing approaches for give problem
2. Develop the skills to design and implement Genetic algorithm solutions to various problems
3. Applying Fuzzy Logic and the techniques of Neuro-fuzzy models.
4. Effectively use existing tools to solve real problems using a soft computing approach
5. Analyze various neural network architectures and apply the suitable model to solve engineering problems
6. Apply the genetic algorithms to combinatorial optimization problems

UNIT-I

Introduction to Soft Computing and Neural Networks: Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics.

UNIT - II

Genetic Algorithms**:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning, Machine, Learning Approach to Knowledge Acquisition.

UNIT- III

Neural Networks: Machine Learning Using Neural Network. Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT- IV

Fuzzy Logic**:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT - V

Neuro-Fuzzy Modeling: Adaptive Neuro, Fuzzy Inference Systems, Coactive Neuro, Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification, Neuro, Fuzzy Control, Case studies.

Suggested Reading:

1. Iyh, Shlng Roger Jang, Chuen,Tsai Sun, EijiMizutani, "**Neuro, Fuzzy and Soft Computing**", Prentice, Hall of India, 2003.
2. George J. Klir and Bo Yuan, "**Fuzzy Sets and Fuzzy Logic, Theory and Applications** ", Prentice Hall 1995.

Reference Books:

1. James A. Freeman and David M. Skapura, "**Neural Networks Algorithms, Applications, and Programming Techniques**", Pearson Edn., 2003.
2. Mitchell Melanie, "**An Introduction to Genetic Algorithm** ", Prentice Hall, 1998.
3. David E. Goldberg, "**Genetic Algorithms in Search. Optimization and Machine Learning**", Addison Wesley, 1997.

Course Code: 16CSE253

HIGH PERFORMANCE SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of high performance systems are:

1. To introduce students to high performance computing systems in science and engineering
2. Expose students to the features of modern processors that affects performance and be able to use these features in the design and optimization of high-performance software.
3. To utilize techniques to automatically implement, optimize, and adapt programs to different platforms.
4. To provide the concepts of parallel processing and develop the skills required to implement high-performance software
5. Learn techniques for analyzing the performance of programs and their interaction with the underlying hardware.

Course Outcomes:

Upon successful completion of the course the student will

1. Acquire knowledge to develop and execute parallel programs on high performance computing resources using parallel programming paradigms such as MPI
2. Have an understanding of the various high performance computing and their potential for performance and programmability.
3. Identify high performance computing paradigms like cluster, grid, heterogeneous and cloud computing
4. Be capable of developing algorithms that yield good performance on high performance architectures and be able to estimate and evaluate their performance.
5. Analyze a given problem for possibilities of parallel computations
6. Have an awareness of modern field of computational science and engineering and of the impact of high performance computing on industry

UNIT-1

Modern Processors: Stored-program computer architecture, General-purpose cache-based microprocessor architecture, Memory hierarchies, Multicore processors, multithreaded processors, Vector processors.

Basic Optimization Techniques for Serial Code: Scalar profiling, Common sense optimizations, Simple measures, large impact, the role of compilers C++ optimizations

Data Access Optimization: Balance analysis and light-speed estimates, Storage order (Case studies: The Jacobi algorithm and Dense matrix transpose), Algorithm classification and access optimizations (Case study: Sparse matrix-vector multiply)

UNIT-1I

Parallel Computers: Taxonomy of parallel computing paradigms, Shared-memory computers, Distributed-memory computers, Hierarchical (hybrid) systems Networks

Basics of Parallelization: Why parallelize? Parallelism, Parallel scalability

Shared-Memory Parallel Programming with OpenMP: Short introduction to OpenMP (Case study: OpenMP-parallel Jacobi algorithm),Advanced OpenMP: Wave front parallelization

Distributed-Memory Parallel Programming with MPI: Message Passing, A short introduction to MPI, Example: MPI parallelization of a Jacobi solver

Hybrid Parallelization with MPI and OpenMP: Basic MPI/OpenMP programming models, MPI taxonomy of thread interoperability ,Hybrid decomposition and mapping Potential benefits and drawbacks of hybrid programming

UNIT-1II

The brewing trends and transformations in the IT landscape: Introduction,The Emerging IT Trends, The Realization and Blossoming of Digitalized Entities**,** The Internet of Things (IoT)/Internet of Everything (IoE)**,**The Tremendous adoption of Social Media Sites**,** The Ensuring Era of Predictive, respective and Personalized Analytics**,** Apache Hadoop for Big Data and Analytics**,** Big Data into Big Insights and Actions**,** Conclusions.

The high performance Technologies: Introduction, The Emergence of Big Data Analytics(BDA) Discipline, The Strategic Implications of Big Data, The Big Data Analytics Challenges, The high-Performance Computing(HPC)Paradigms for fast and BDA,The High-Performance Approaches Through parallelism, Cluster computing, Grid computing, Cloud computing, Heterogeneous computing, Main Frames for High-performance Computing, Supercomputing for Big data Analytics, Appliances for Big Data Analytics

UNIT-IV

Network infrastructure for High –Performance: Introduction, Network Infrastructure for High performance Computing, Limitations of Present-Day Networks**,** Approaches for the Design of Network Infrastructure for High-Performance Big Data Analytics

Storage Infrastructure for High-Performance Big Data Analytics: Introduction, Storage Area Networks, Storage Infrastructure for storing big data, FC SAN, IP SAN, FCoE, NAS

UNIT-V

Real –Time Analytics Using High-Performance Computing: Introduction, Technologies That support Real-time Analytics, Processing in Memory(PIM), In-Database Analytics, MOA: Massive Online Analysis, General Parallel File System(GPFS)

High-performance Computing (HPC) Paradigms: Introduction, need of Mainframes, Cost-An Important Factor for HPC, Cloud Computing Centralized HPC, Requirements to Centralized HPC,HPC Remote Simulation

Suggested Reading:

1. **"Introduction to High Performance Computing for Scientists and Engineers**", Chapman & Hall/CRC Computational Science 2010 by Georg Hager, Gerhard Wellein
2. Pethuru Raj, Anupama Raman, Dhivya Nagaraj, "**High-Performance Big Data Analysis: Computing Systems and Approches**", 1st ed. 2015, Springer.

Reference Books:

1. CUDA by Example, "**An Introduction to General-Purpose GPU Programming** "
2. Michael J Quinn, "**Parallel programming in C with MPI and OpenMP**", Tata McGraw Hill, 2003.
3. Kaihwang and NareshJotwani, "**Advanced Computer Architecture**" 2nd edition Tata McGraw-Hill References:

Course Code: 16CSE261

SOFTWARE REUSE TECHNIQUES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should able

1. To explain the benefits of software reuse.
2. To understand and several different ways to implement software reuse techniques.
3. To explain how reusable concepts can be represented as patterns.
4. To comprehend the nature of design patterns.
5. To provide a specific context for each pattern in which it is applied.

Course Outcomes:

Upon successful completion of the course

1. Students will be able to identify and describe the different approaches and techniques to the software reuse development.
2. Students will be able to determine and apply the knowledge acquired on software reuse techniques.
3. Students should be able to apply the design patterns in creating an object oriented design.
4. Students will be able to use design patterns for real world situations.
5. Students should able to list consequences of applying each pattern.
6. Student will understand the benefits of a pattern approach over program in a software application.

UNIT – I

Software reuse success factors, Reuse driven software engineering as business, object oriented software engineering, Applications and Component subsystems, Use case components, Object components.

UNIT – II

Design Patterns – Introduction. Creational Patterns – Factory, factory method, abstract factory, singleton, builder, prototype.

UNIT – III

Structural Patterns – Adapter, bridge, composite, decorator, façade, flyweight, proxy. Behavioral Patterns – Chain of responsibility, command, interpreter.

UNIT – IV

Behavioral Patterns – Interartor, mediator, memento, observer, state, strategy, template, visitor. Other design patterns – Whole – part, master – slave, view handler, forwarder – receiver, client dispatcher – server, publisher – subscriber.

UNIT – V

Architectural Patterns – Layers, pipes and filters, black board, broker, model-view controller, presentation – abstraction – control, micro kernel, reflection.

Suggested Reading:

1. Ivar Jacabson, Martin Griss, Patrick Johnson, "**Software Reuse: Architecture, Process and Organization for Business Success**", ACM Press 1997.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides – "**Design Patterns**", Pearson Education, 1995.
3. Frank Buschmann etc., "**Pattern Oriented Software Architecture – Volume I**", Wiley 1996.
4. James W Cooper, "**Java Design Patterns, a tutorial**", Pearson Education, 2000.

Course Code: 16CSE262

STORAGE MANAGEMENT

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should able

1. To understand Storage Area Networks characteristics and components
2. To become familiar with the SAN vendors and their products
3. To learn Fibre Channel protocols and how communications used in SAN components.
4. To become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switche thoroughly learn Cisco SAN-OS features.
5. To understand the use of all SAN-OS commands. Practice variations of SANOS features

Course Outcomes:

Upon successful completion of the course, student can

1. Able to identify key challenges in managing information and analyze different storage networking technologies.
2. Able to understand components and the implementation of NAS
3. Able to understand CAS architecture and types of archives and forms of virtualization
4. Understand Storage security and Management
5. Able to monitor the storage infrastructure and management activities.

UNIT-I

Introduction To Storage Technology: Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

UNIT-II

Storage Systems Architecture: Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems High-level architecture and working of an intelligent storage system 67

UNIT-III

Introduction To Networked Storage: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments

UNIT-IV

Information Availability, Monitoring & Managing Datacenter:List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime - Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, Architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

UNIT-V

Securing Storage And Storage Virtualization: Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

Suggested Reading:

1. G.Somasundaram, Alok Shrivastava, EMC Education Series, "**Information Storage and Management**", Wiley, Publishing Inc., 2011.

Reference Books:

1. EMC Corporation,"**Information Storage and Management**", Wiley, India.
2. Robert Spalding, "**Storage Networks: The Complete Reference**", Tata McGraw Hill , Osborne, 2003.
3. Marc Farley, "**Building Storage Networks**", Tata McGraw Hill ,Osborne, 2001.
4. Additional resource material on www.emc.com/resource-library/resource-library.esp

Course Code: 16CSE263

STREAMING TECHNOLOGY

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should able

1. To understanding the need for stream computing
2. To comprehend the architecture of stream analytics
3. To build the data flow management pipelines for streams.
4. To processing streaming data
5. To explain delivering the results of streaming analytics

Course Outcomes:

After the completion of this course, the student will be able to

1. Differentiate between types of Streaming Data.
2. Understand the architecture of Stream Anlaytics
3. Demonstrate the Distributed Data flows
4. Apply concepts to Streaming Data
5. Apply different metrics to real world Problems

UNIT-I

INTRODUCTION TO STREAM COMPUTING

Streaming Data – Sources – Difference between Streaming Data and Static Data. Overview of Large Scale Stream Processing Engines – Issues in Stream Processing.

UNIT-II

STREAMING ANALYTICS ARCHITECTURE

Phases in Streaming Analytics Architecture - Vital Attributes - High Availability – Low Latency – Horizontal Scalability-Fault Tolerance - Service Configuration and Management - Apache ZooKeeper.

UNIT-III

DATA FLOW MANAGEMENT

Distributed Data Flows – At Least One Delivery – Apache Kafka – Apache Flume – Zero MQ - Messages, Events, Tasks & File Passing.

UNIT-IV

PROCESSING & STORING STREAMING DATA

Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions. Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing a storage system – NoSQL Storage Systems.

UNIT-V

DELIVERING STREAMING METRICS

Visualizing Data – Mobile Streaming Apps –Times Counting and Summation - Stochastic Optimization – Delivering Time Series Data.

Suggested Reading:

1. Byron Ellis, "**Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data**", Wiley, 1st edition, 2014.
2. Sherif Sakr, "**Large Scale and Big Data: Processing and Management**", CRC Press, 2014. 2014.

Reference Books:

1. Bill Franks, "**Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics**", Wiley, 2012.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "**Mining of Massive Datasets**", Cambridge University Press, 2014.
3. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos, "**Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data**", McGraw-Hil, 1st edition, 2011.

Course Code: 16CSC104

ADVANCED DATABASES LAB (LAB-1)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Course Objectives:

At the end of the course should get:

1. To understand and apply the concepts of Object Oriented Databases.
2. To design and implement queries using XML Database.
3. To design and implement a complete problem solution using Relational Databases.
4. To Understand the basics of advanced topics such as Parallel Databases, Distributed Databases and Spatial Databases

Course Outcomes:

Upon Successful Completion of Course, Students will

1. Be familiar with a Object Oriented Databases and be able to develop application based on it.
2. Be familiar with the XML databases and be able to write queries related to it.
3. Be able to construct an Entity Relationship (ER) model from specifications and to transform them to relational model.
4. Be able to develop database application using Relational Databases.
5. Master the advanced concepts and appreciate the applications of database systems.
6. Master the basics of Parallel Databases, Distributed Databases and Spatial Databases.

PRACTICALS:

1. Develop a database application to demonstrate the representation of multi-valued attributes and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

2. Write an XML to display the book information, which includes the following:
   Title of Book
   Author Name
   ISBN Number
   Publisher Edition
   Price

3. A. Write a DTD to validate XML File
   B. Display XML as follows
   i) The contents should be displayed in a table. The header of table should be in Grey color
   ii) The author Names column should be displayed in one color & capitalized & should be in bold
   iii) Use your own colors for remaining columns. Use XSL & CSS for above purpose.

4. Write a program that uses the SAX parser to extract all elements with a particular tag. The user should be able to provide a tag name, and your program should show all instances of that tag.

5. Write a program that uses the DOM parser to provide a searchable interface to the document. The user should be able to provide an element type and value, and your program should display the corresponding data

6. Design XML Schema for the given company database

   Department (deptName, deptNo, deptManagerSSN,
   deptManagerStartDate, deptLocation)
   Employee (empName, empSSN, empSex, empSalary, empBirthDate, empDeptNo,
   empSupervisorSSN, empAddress, empWorksOn)
   Project (projName, projNo, projLocation, projDeptNo, projWorker)

   a). Write XML file to store Department, Employee and Project details.
   b). Write the queries using Xquery and Xpath and execute it using XQuery Engine.

   (i)Retrieve the department name, manager name, and manager salary for every department.

   (ii)Retrieve the employee name, supervisor name and employee salary for each employee who works in the Research Department.

   (iii)Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project.

7. Experiments on SQL Commands, joins, constraints and functions.
8. Design and implement library management system in RDBMS
   a) Collect the essential requirements for library management system such as student details, book details, issue.
   b) Define the entity sets and the attributes for library management system
      i. **Student details** – stud name, studno,
      ii. **Book details** – bookno, title, author name, book type.
   c) Define the Relationship sets such as lender, borrower, issue.
   d) Represent the strong and weak entity sets
   e) Design E-R diagram for library management system

   Reduce the E-R schema of library management system into tables using generalization and aggregation.

9. Case studies on Parallel Databases, Distributed Database and Object Oriented Databases .

Suggested Reading:

1. "**Database System Concepts**",Avi Silberschatz ,Henry F. Korth and S.Sudarshan.Sixth Edition. McGraw Hill.

Course Code: 16EG104

SOFT SKILLS LAB
(Activity-based)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	--	3 Hours	--	2

Course Objectives:
To help the students
1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To be competent in verbal aptitude.

Course Outcomes:
The students will be able to
1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to mange time effectively and deal with stress.
4. Make the transition smoothly from campus to corporate. Also use media with etiquette and know what academic ethics are.
5. Correct and complete sentences, have a good vocabulary and comprehend passages confidently

PRACTICALS:

Exercise 1

Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2

Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3

Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4

Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary.
Reading comprehension

Suggested Reading:

1. Leena Sen , "**Communication Skills**", Prentice-Hall of India, 2005
2. Dr. Shalini Verma, "**Body Language- Your Success Mantra**", S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , "**Objective English**", 2nd edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills**", New Delhi: Pearson, 2010
5. Gulati and Sarvesh, " **Corporate Soft Skills**", New Delhi: Rupa and Co. , 2006
6. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004
7. "**A Modern Approach to Verbal & Non-Verbal Reasoning**" by R S Aggarwal
8. Covey and Stephen R, "**The Habits of Highly Effective People**", New York: Free Press, 1989

Course Code: 16CSC105

SEMINAR-I

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

Literature Survey
Organization of material
Preparation of PowerPoint presentation slides
Technical Writing

Each Student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

SCHOLARLY WRITING

- Learn how to use the scientific method
- Discuss your topic with fellow students
- Find literature sources
- Develop scholarly writing skills
- Develop critical thinking skills
- Investigate professors that are potential guides
- Learn about engineering requirements
- Develop bibliographic organization and citation skills
- Prepare a report

Course Code: 16CSC204

BIG DATA ANALYTICS LAB (LAB-2)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Course Objectives:

At the end of the course student should able

1. To provide the knowledge on how to apply the methods using R for big data analysis.
2. To explore the statistical methods that can be used for analysis.
3. To implement the exploring and analysis of big data on a real world problem.
4. To apply the classification and clustering techniques on big data.
5. To execute the Hadoop techniques on big data for analysis.
6. To grasp the Hadoop Ecosystem

Course Out comes:

Upon completion of this course, Student will be able to:

1. Deploy a structured lifecycle approach to data science and big data analytics projects.
2. Reframe a business challenge as an analytics challenge.
3. Apply analytic techniques and tools to analyze big data.
4. Create statistical models, and identify insights that can lead to actionable results
5. Use tools such as R and RStudio, Hadoop, in-database analytics
6. Apply big data techniques for real world problems.

PRACTICALS:

1. Review of Basic Data Analytic Methods Using R
   - Using R to Look at Data
   - Introduction to R
   - Analyzing and Exploring the Data
   - Statistics for Model Building and Evaluation
2. Advanced Analytics - Theory and Methods
   - K-means Clustering
   - Association Rules
   - Linear Regression
   - Logistic Regression
   - Naive Bayesian Classifier
   - Decision Trees
   - Time Series Analysis
   - Text Analysis
3. Advanced Analytics - Technology and Tools
   - Analysis for Unstructured Data (MapReduce and Hadoop)
   - The Hadoop Ecosystem

Suggested Reading:

1. Tom white, "**Hadoop: The Definitive Guide**", 4th edition, O'Reilly Media Inc. ,April 2015
2. Vignesh Prajapati, " **Big data Analytics with R and Hadoop**", Packt Publishing, Nov 2013.

Reference Books:

1. Luca Massaron, Alberto Boschetti, "**Python Data Science Essentials**", Packt Publications, April 2015
2. Robert I. Kabacoff, "**R in Action Data analysis and graphics with R**", Manning Publications, May 2015.

Web Resources:

1. www.bigdatascienceschool.com/store
2. www.iitr.ac.in/media/facspace/patelfee/16Bit/index.html
3. www.class.coursera.org/datasci-001/lecture
4. www.bigdatauniversity.com

Course Code: 16CSC205

SEMINAR-II

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

- Literature Survey
- Organization of material
- Preparation of PowerPoint presentation slides
- Technical Writing

Each Student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

SCHOLARLY WRITING

- Learn how to use the scientific method
- Discuss your topic with fellow students
- Find literature sources
- Develop scholarly writing skills
- Develop critical thinking skills
- Investigate professors that are potential guides
- Learn about engineering requirements
- Develop bibliographic organization and citation skills
- Prepare a report

Course Code: 16CSC206

MINI PROJECT

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
2 Periods per week	50	3 Hours	--	1

Student should carry out mini project in the area of interest/course studied, identifying a real time problem under the supervision of guide.

Mini Projects will be monitored during the semester through individual presentations.

Every student should maintain a mini project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a mini project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the mini project report, the students are directed to download from the website regarding the guidelines for preparing the mini project report and the mini project report format.

The mini project report shall be evaluated for 50 Marks and credits 1 by the committee.

If the mini project work found inadequate in the end examination, the candidate should repeat the mini project work with a new problem or improve the quality of work and report it again.

1. Power point presentation
2. Thesis/Report preparation
3. Viva - voce