

Faculty of Engineering

Syllabus

**B.E. (Information Technology) 2012 Course
(With effect from Academic Year 2015 - 16)**

SAVITRIBAI PHULE PUNE UNIVERSITY

THE SYLLABUS IS PREPARED BY:

B.O.S. in Information Technology, Savitribai Phule Pune University

PROGRAM EDUCATIONAL OBJECTIVES

The students of Information Technology course after passing out will

- 1.** Graduates of the program will possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
- 2.** Possess knowledge and skills in the field of Computer Science & Engineering and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
- 3.** Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science & Engineering and Information Technology.
- 4.** Have commitment to ethical practices, societal contributions through communities and life-long learning.
- 5.** Possess better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

1. an ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, and engineering and technology;
2. an ability to define a problem and provide a systematic solution with the help of conducting experiments, as well as analyzing and interpreting the data;
3. an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints;
4. an ability to identify, formulate, and provide systematic solutions to complex engineering problems;
5. an ability to use the techniques, skills, and modern engineering technologies tools, standard processes necessary for practice as a IT professional;
6. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions;
7. an ability to analyze the local and global impact of computing on individuals, organizations and society;
8. an ability to understand professional, ethical, legal, security and social issues and responsibilities;
9. an ability to function effectively as an individual or as a team member to accomplish a desired goal(s);
10. an ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities;
11. an ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations;
12. an ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice;
13. an ability to apply design and development principles in the construction of software systems of varying complexity.

B.E. (Information Technology) 2012 Course to be implemented from June 2015**SEMESTER – I**

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks
		Lecture	Practical	Tutorial	In-Semester Assessment	TW	PR	OR	End Semester Examination	
					Phase - I				Phase - II	
414453	Information and Cyber Security	3			30				70	100
414454	Software Modeling and Design	3			30				70	100
414455	Machine Learning	4			30				70	100
414456	Elective – I	3			30				70	100
414457	Elective – II	3			30				70	100
414458	Software Laboratory - III	--	4	--		50	--	50		100
414459	Software Laboratory - IV	--	4	--		--	50	50		100
414460	Project Phase I	--	--	2		50	--	--		50
Total		16	8	2	150	100	50	100	350	750

Software Laboratory – III: (Information and Cyber Security + Machine Learning)

Software Laboratory – IV: (Software Modeling and Design + Testing)

Elective – I	Elective – II
414456 A : Soft Computing	414457 A : Business Intelligence
414456 B : Usability Engineering	414457 B : Service Oriented Architecture
414456 C : Modern Compilers	414457 C : E&M Governance
414456 D : Parallel Algorithms and Design	414457 D : Geo Informatics Systems
414456 E : Cloud Computing	414457 E : Natural Language Processing

SEMESTER – II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks
		Lecture	Practical	Tutorial	In-Semester Assessment	TW	PR	OR	End Semester Examination	
					Phase - I				Phase - II	
414461	Distributed System	3			30				70	100
414462	Advanced Databases	3			30				70	100
414463	Elective – III	3	2	--	30	25	--	25	70	150
414464	Elective – IV	3			30				70	100
414465	Software Laboratory - V	--	2	--		25	25	--		50
414466	Software Laboratory - VI	--	4	--		--	50	50		100
414467	Project Work	--	--	6		50	--	100		150
Total		12	8	6	120	100	75	175	280	750

Software Laboratory – V: (Distributed Systems)
 Software Laboratory – VI: (Advanced Databases)

Elective – III	Elective – IV
414463 A :Mobile Computing	414464 A :Bio Informatics
414463 B :Advanced Graphics and Animation	414464 B :Real Time and Embedded Systems
414463 C :Information Storage and Retrieval	414464 C :Green IT - Principles and Practices
414463 D :IT Enabled Services	414464 D :Internet of Things
414463 E :Advanced Computer Networks	414464 E :Open Elective

SEMESTER - I

414453 : INFORMATION AND CYBER SECURITY**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites:**Data Communication and Computer Networks**Course Objectives :**

1. Understand the essentials of information security.
2. Learn the algorithms for implementing security
3. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security

Course Outcomes :

The learning outcomes are:

- Students shall be able to understand what are the common threats faced today
- What is the foundational theory behind information security
- What are the basic principles and techniques when designing a secure system
- How today's attacks and defenses work in practice
- How to assess threats for their significance and
- How to gauge the protections and limitations provided by today's technology

UNIT - I SECURITY FUNDAMENTALS**6 Hours**

Introduction, Terminology, Attacks, Security Goals : Authentication, Authorization, Cipher Techniques: Substitution and Transposition, One Time Pad, Modular Arithmetic, GCD, Euclid's Algorithms, Chinese Remainder Theorem, Discrete Logarithm, Fermat Theorem, Block Ciphers, Stream Ciphers. Secret Splitting and Sharing.

UNIT - II CRYPTOGRAPHY**6 Hours**

Symmetric Key Algorithms: DES, AES, BLOWFISH, Attacks on DES, Modes of Operations, Linear Cryptanalysis and Differential Cryptanalysis, Public Key Algorithms: RSA, Key Generation and Usage.

UNIT - III MESSAGE DIGEST AND KEY MANAGEMENT**6 Hours**

Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, PKI. Diffie-Hellman Key Exchange. One Way Authentication, Mutual Authentication, Kerberos 5.0.

UNIT IV NETWORK SECURITY**6 Hours**

Layer Wise Security Concerns, IPSEC- Introduction, AH and ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol. Intrusion Detection Systems: Introduction, Anomaly Based, Signature Based, Host Based, Network Based Systems.

UNIT - V INTRODUCTION TO CYBER SECURITY**6 Hours**

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective ,Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyberstalking, Cloud Computing and Cybercrime

UNIT – VI TOOLS AND METHODS USED IN CYBERCRIME**6 Hours**

Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS ,SQL injection, Cybercrime and Legal perspectives, Cyber laws- Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures.

Text Books

1. Bruce Schneier, "Applied Cryptography- Protocols, Algorithms and Source code in C", 2nd Edition, Wiley India Pvt Ltd, ISBN 978-81-265-1368-0
2. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt.Ltd., ISBN- 978-81-265-2179-1
3. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, ISBN-978-81-315-1349-1

Reference Books

1. Nina Godbole, " Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
2. William Stallings, "Computer Security : Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6
3. Mark Merkow, " Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7
4. CK Shyamala et al., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9
5. Berouz Forouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN :9780070702080

414454 : SOFTWARE MODELING AND DESIGN

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

Phase I – 30 Marks

End-Semester Assessment

Phase II – 70 Marks

Prerequisites : Problem Solving & Object Oriented Programming, Software Engineering

Course Objectives :

1. Based on user requirements, create a requirement model using UML class notations and use-cases.
2. Create an OO design of a system from the requirements model in terms of a high-level design description, and low-level models of structural organization and dynamic behavior using relevant UML diagrams.
3. Comprehend the importance of GOF design patterns by implementing few simple design patterns.
4. Validate software implementation for its correctness and quality using appropriate testing.

Course Outcomes :

Students will be able to

1. understand the usage of various UML diagrams to build a model
2. prepare an object oriented model in business domain of an application.
3. prepare an object oriented model in solution domain.
4. apply object oriented principles in the design of software system.
5. get started on study of GOF design patterns.
6. understand different types of software testing.

UNIT – I INTRODUCTION TO MODELING AND CLASS MODEL

6 Hours

Modeling as a design technique, abstraction, three models, object and class concepts, links and association concepts, generalization and inheritance concepts, navigations in class models, advanced object and class concepts, association ends, n-ary association, aggregation, abstract classes, multiple inheritance, metadata, reification, constraints, derived data, packages.

UML diagrams: Object, class, package diagram.

UNIT – II STATE MODELING AND INTERACTION MODEL

6 Hours

Events, states, transitions and conditions, state diagram, state diagram behavior, nested state diagram, nested states, signal generalization, concurrency, state model case study, relation of class and state model, Use case models, sequence models, activity models, use case relationships, procedural sequence model, and special constructs for activity models

State, activity, use case, sequence diagrams.

UNIT – III SYSTEM ANALYSIS

6 Hours

Find classes, prepare data dictionary, find associations, find attributes of objects and links, organize and simplify classes using inheritance, verification of access paths, reconsider the level of abstraction, group classes into packages, determine system boundary, find actors, find use cases, find initial and final events, prepare normal scenarios, add variation and exception scenarios, find external events, prepare activity diagram for use cases.

UNIT – IV SYSTEM DESIGN**6 Hours**

Estimate system performance, make a reuse plan, organize the system into subsystem, identify concurrency inherent in the problem, allocate subsystems to hardware, manage data stores, handle global resources, choose a software control strategy, handle boundary conditions, set trade off priorities, select an architectural style, Component and deployment diagram.

UNIT – V DESIGN PATTERNS**6 Hours**

Types of design patterns, design pattern documentation, study of GOF design patterns namely strategy, observer, state, and adaptor.

UNIT - VI SOFTWARE TESTING**6 Hours**

Testing Terminologies: Verification and validation, Fault, error, bugs and failure, test case and test suite, white box testing and black box testing. V-test model: User Acceptance testing, integration testing, unit testing, and Introduction to test driven development.

Text Books

1. Michael R Blaha, James Rumbaugh, "Object Oriented Modeling and Design with UML", Second Edition, Pearson Education System.
2. Dennis, Wixom, Tegarden, "System Analysis and design - an Object oriented approach with UML", 5th Edition, Wiley publication.
3. M G Limaye, "Software Testing Principle, Techniques and Tools", TMH.

Reference Books

1. Grady Booch, "Object oriented analysis and design with application, third edition", Pearson Education.
2. Dan Pilone, " UML 2.0 in a Nutshell", O'Reilly.
3. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language User Guide", Second Edition, Addison Wesley Object Technology Series.
4. Jim Arlow, "UML 2 and the Unified Process: Practical Object Oriented Analysis and design", Second Edition, , Addison Wesley Object Technology Series.
5. Erich Gamma and others, "Design Patterns: Reusable elements of object oriented software", Pearson Education Series.
6. Hasan Gomma, Software Modeling and Design, Cambridge University Press India.

414455 : MACHINE LEARNING

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks

Prerequisites : Linear Algebra and Calculus, Probability Basics

Course Objectives :

1. Understanding Human learning aspects.
2. Understanding primitives in learning process by computer.
3. Understanding nature of problems solved with Machine Learning.

Course Outcomes :

1. Students will be able to model the learning primitives.
2. Students will be able to build the learning model.
3. Student will be able to tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

UNIT – I INTRODUCTION TO MACHINE LEARNING

7 Hours

Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

UNIT – II CLASSIFICATION AND REGRESSION

8 Hours

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.

Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

UNIT – III LINEAR MODELS

7 Hours

Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

UNIT – IV LOGIC BASED AND ALGEBRAIC MODELS

6 Hours

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering,

Rule Based Models: Rule learning for subgroup discovery, Association rule mining.

Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

UNIT – V PROBABILISTIC MODELS

6 Hours

Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

UNIT – VI TRENDS IN MACHINE LEARNING**8 Hours**

Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text Books

1. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.

Reference Books

1. C. M. Bishop : Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.
3. Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, Wiley-IEEE Press, Edition July 2012.

414456 A - ELECTIVE I : SOFT COMPUTING**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites:** Linear Algebra and Calculus 2. Probability Theory**Course Objectives :**

1. Understanding differential behavior of Human and Intelligence Systems.
2. Understanding nature of problems solved with Soft Computing.
3. Understanding components of Soft Computing.

Course Outcomes :

1. Students will be inspired to solve complex real-world problems.
2. Students will correlate human-like processing in problem solving with current technologies in various domains like Bio Informatics, Multimedia Systems, Big Data Analytics, etc.
3. Student will be able to tackle problems of interdisciplinary nature.

UNIT – I INTRODUCTION TO INTELLIGENT SYSTEMS AND SOFT COMPUTING 5 Hours

Characteristic behavior of Intelligent systems, Knowledge based systems, Knowledge Representation and Processing, Soft Computing characteristics, Constitutes of Soft Computing-Fuzzy Logic and Computing, Neural Computing, Evolutionary Computing, Rough Sets, Probabilistic Reasoning and Machine Learning.

UNIT – II NEURO COMPUTING- SUPERVISED LEARNING 6 Hours

Biological background, Pattern recognition tasks, Features of artificial neural networks, Activation functions, Perceptron model, Perceptron for classification and its limitations, Architectures of multilayer feed-forward neural networks, Back-propagation learning algorithm, Limitations of MLP.

UNIT - III NEURO COMPUTING- UNSUPERVISED LEARNING 7Hours

Hebb's learning rule for competitive learning, Kohonen's self-organizing map and network topology, applications of SOM, Hopfield network and its topology, Boltzman Machines, Adaptive Resonance Theory.

UNIT - IV FUZZY LOGIC AND FUZZY SYSTEMS 7 Hours

Evolution of fuzzy logic, fuzzy sets, fuzzy logic operations, fuzzy relations, Fuzzy arithmetic and fuzzy measures. Fuzzy rules and reasoning, Fuzzy inference systems, Fuzzy modeling and decision making, Neuro-fuzzy modeling.

UNIT – V EVOLUTIONARY COMPUTING 6 Hours

Biological background and Overview of evolutionary computing, Genetic algorithm and search space, Operators in genetic algorithm- encoding, selection, crossover, and mutation, Classification of GA, Evolutionary Programming and Strategies.

UNIT - VI APPLICATIONS OF SOFT COMPUTING TECHNIQUES 5 Hours

Applications of fuzzy in pattern recognition-character recognition. Applications of evolutionary computing in Image processing and computer vision, Soft computing in mobile ad-hoc networks, soft computing in Information Retrieval and Semantic web, Soft Computing in Software Engineering.

Text Books

1. Fakhreddine O. Karray, Clarence De Silva, 'Soft Computing and Intelligent systems design' Pearson Education, ISBN 978-81-317-2324-1.
2. B. K. Tripathy, J. Anuradha, 'Soft Computing: advances and applications', Cengage learning, ISBN-13: 978-81-315-2619-4.

Reference Books

1. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley publications, 2nd Edition.
2. J. S. R. Jang, C. T. Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence' PHI,
3. David E. Goldberg , Genetic Algorithms - Pearson Education, 2006
4. Satish Kumar, "Neural Networks - A Classroom Approach", Tata McGraw,Hill

414456 B - ELECTIVE I : USABILITY ENGINEERING**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites :** Human Computer Interaction and Usability**Course Objectives :**

1. To introduce the need for human-computer-interaction study or human-centered software design.
2. To explain usability engineering lifecycle for designing a user-friendly software.
3. To familiarize information, interaction and GUI design process for enhancing user-experience.
4. To develop usability evaluation skills for software testing.
5. To explain industry standards for designing and evaluating use-interfaces.
6. To make aware of the current trends in usability engineering.

Course Outcomes :

At the end of this course, student should be able to:

1. Justify the need to study human-computer-interaction or human-factors while designing software.
2. Discuss the process of designing user-friendly software based on usability engineering guidelines.
3. Apply interaction design and UI design process in enhancing user-experience of an application.
4. Conduct usability evaluation of user-interfaces or software applications.
5. Discuss industry standards for designing and evaluating user-interfaces.
6. Discuss current trends in usability engineering

UNIT – I HCI AND USABILITY**3 Hours**

What is HCI design? Disciplines contributing to HCI, Psychology of everyday things, Importance of human factors in design, Need Satisfaction curve of technology, Levels of human computer interaction
What is Usability? benefits and cost savings, usability slogans, attributes of system acceptability, definition of usability, usability trade-Offs , categories of users and individual user differences, generations of user interfaces, scenario-based usability engineering case study - A Virtual Science Fair.

UNIT – II THE USABILITY ENGINEERING LIFECYCLE**9 Hours**

User research and requirements analysis → know the user, user-profile questionnaire, field-study methods, contextual inquiry and analysis, hierarchical task analysis, ethnography, cultural probe, affinity diagramming, persona, scenarios of use, use cases.

Iterative Design → setting usability criteria or goals, participatory design (getting users involved), guidelines and heuristic evaluation, prototyping and scenarios , examples of problem scenarios, iterative design, interface evaluation, meta methods.

Usability Heuristics → simple and natural dialogue, speak the users' language, minimize user memory load, consistency, feedback, clearly marked exits, shortcuts, good error messages, prevent errors, help and documentation, heuristic evaluation.

UNIT – III INFORMATION DESIGN AND INTERACTION DESIGN**6 Hours**

Information design → Information architecture concepts, stages of action in human-computer interaction, perceiving information, interpreting information, making sense of information.

Interaction Design → selecting system goal, planning action sequence, executing action sequence, case

study of information and interaction design

User Interface Design → Goals of UID, User Interface Models , conceptual model and mock-ups of GUI, choosing prototyping alternatives - paper prototyping, rapid prototyping, storyboarding, wireframes, Cost/benefit of good interface design , Case Study.

UNIT – IV USABILITY EVALUATION

10 Hours

Developing usability specifications for evaluation - case study, criteria for user feedback techniques, formative and summative techniques of evaluation

Usability Inspections (testing without users) → heuristic evaluation, user-interface guideline reviews, cognitive walkthrough, model-based analysis

Usability Testing (testing with users) → developing usability or test specifications with case study , test goals and test plans , getting test users, choosing experimenters, ethical aspects of tests with human subjects, test tasks, stages of a test, performance measurement, thinking-aloud testing, usability laboratories, remote evaluation,

Methods beyond testing → observation, user satisfaction questionnaire (rating scale), interviews, system usability scale (SUS), focus groups, logging actual use, user feedback, choosing a methods.

UNIT – V USER-INTERFACE AND USABILITY STANDARDS

5 Hours

User benefits, vendor benefits, dangers of standards, principles of good UI design, national-international standards, internationalization - international GUI, guidelines for internationalization , localization and multilocale interfaces, UI standards - control standards, window standards, dialog box standards, message box standards, device interaction standards, feedback standards, developing style guides and toolkits , user documentation- manuals, tutorials, information in the interface.

UNIT – VI RECENT ADVANCES AND TRENDS

3 Hours

Theoretical solutions, technological solutions, CAUSE tools, emerging paradigms of user interaction- collaborative systems, ubiquitous computing , intelligent user-interfaces , simulation and virtual reality , case study , usability issues in organizations- case studies , organizational roles and structures , ethics of usability, web analytics.

Text Books

1. Nielsen, J. (1994), "Usability Engineering", Elsevier.
2. Rosson, M. B., & Carroll, J. M. (2001), " Usability Engineering: Scenario-Based development of human-computer interaction", Elsevier.
3. Mayhew, D. (1999), "The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design", Morgan Kaufmann

Reference Books

1. Cooper A. et. al. (2007), " The Essentials of Interaction Design", Wiley
2. Cooper, A. (1995)," The Essentials of User Interface Design", IDG Books, New Delhi
3. Schneiderman, B. (2005), " Designing the User Interface", Pearson Education, New Delhi
4. Dix A. et. al.(1993), " Human - Computer Interaction", Prentice Hall, USA
5. Mandel, T. , " Elements of User Interface Design", John Wiley & Sons
6. Rogers et. al (2011), " Interaction Design", John Wiley & Sons
7. Norman, D. (1988), "The Design of Everyday Things", Basic Books.
8. Donna Spencer<, "A Practical Guide to Information Architecture"
9. Galitz, W. (2002), "The Essential Guide To User Interface Design", Wiley.

Web-links

1. <http://www.usabilitybok.org/>
2. <http://www.usability.gov/>
3. http://www.webmonkey.com/2010/02/information_architecture_tutorial/
4. <http://www.measuringu.com/>
5. <http://user.medunigraz.at/andreas.holzinger/holzinger%20de/usability%20holzinger.html>

414456 C - ELECTIVE I : MODERN COMPILERS**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites:** Compiler Construction, System Programming**Course Objectives :**

1. To develop an awareness of the function and complexity of modern compilers.
2. To introduce the major concept areas of language translation and compiler design
3. To give students hands-on experience with crafting a simple compiler, working on a sizeable software engineering project, using modern software tools, and most importantly correlating theory.

Course Outcomes :

1. Understand the performance characteristics of modern processors
2. Be familiar with compiler architecture and implementation.
3. Be familiar with register allocation.
4. Be exposed to compiler optimization.

UNIT – I FUNDAMENTALS OF COMPILATION**6 Hours**

Introduction: Modules and Interfaces, Tools and Software, Data Structure for Tree Language, Activation Record: Stack frames, Frames in the Tiger Compiler, Translation to Intermediate Code: Intermediate representation of trees, Translation into trees, Declaration

UNIT - II BASIC BLOCKS OF TRACES**6 Hours**

Canonical Trees, Taming Conditional branches, Instruction Selection: Algorithm for Instructional Selection, CISC Machine, Instruction selection for Tiger Compiler, Liveness Analysis: solution of dataflow equations, Liveness in Tiger compiler

UNIT - III REGISTER ALLOCATION & GARBAGE COLLECTION**6 Hours**

Coloring by simplification, Coalescing, precolored nodes, Graph Coloring implementation, Register allocation for trees, Garbage Collection: Mark and Sweep Collection, Reference Count, Copying Collection, Generational Collection, Incremental Collection, Baker's Algorithm, Interface to the compiler

UNIT - IV FUNCTIONAL PROGRAMMING LANGUAGES**6 Hours**

Canonical Trees, Taming Conditional branches, Instruction Selection: Algorithm for Instructional Selection, CISC Machine, Instruction selection for Tiger Compiler, Liveness Analysis: solution of dataflow equations, Liveness in Tiger compiler

UNIT - V INTER-PROCEDURAL ANALYSIS AND OPTIMIZATION**6 Hours**

Inter-procedural Control flow analysis: The Call Graph, Inter-procedural Dataflow analysis, Inter-procedural Constant Propagation, Inter-procedural Alias Analysis, Inter-procedural optimization, Register allocation, Aggregation and Global References, Other issues in inter-procedural program management Optimizing for memory Hierarchy: Impact on Data of Instruction Cache, Instruction Cache optimization

UNIT - VI POLYMORPHIC TYPE & DATAFLOW ANALYSIS**6 Hours**

Parametric Polymorphism, Type Inference, representation of polymorphic variables, Resolution of static overloading, Intermediate representation of flow analysis , various dataflow analysis, speeding up dataflow analysis, Alias Analysis, Introduction to cloud, Hybrid compiler, cloud based hybrid compiler, architecture of hybrid compiler.

Text Books

1. Advanced Compiler Design Implementation By Steven S. Muchnick ISBN1-55860-320-4
Morgan Kaoufmann Publisher

Reference Books

1. Modern Compiler Implementation in C By Andrew W. Appel, Maia Ginsburg ISBN 0-521-58390
2. Starting Out With Modern Compiler Design (W/Cd) By David Gaddis, Scott Jone
3. Modern Compiler Design By Galles Person Publication, ISBN 978-317-0941-2
4. Compilers: Principles, Techniques and Tools by A. V. Aho, R. Sethi, J. D. Ullman. Addison-Wesley, 1986.
5. Web-based C++ Compiler Aleksander Malinowski, Bogdan M. Wilamowski Bradley University, Peoria, IL / University of Wyoming, Laramie, WY.
6. Shuai Zhang Shufen Zhang Xuebin Chen XiuzhenHuo, Cloud Computing Research and Development Trend, Future Networks, 2010. ICFN '10. Second International Conference.

414456 D - ELECTIVE I : PARALLEL ALGORITHMS AND DESIGN**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites :** Discrete Structures, Design and Analysis of Algorithms**Course Objectives :**

1. To study the parallel architecture of the processor.
2. To study various parallel algorithmic strategies and their comparison with traditional algorithmic strategies.
3. To study the analysis of parallel algorithms in terms of time and space complexity.
4. To classify the parallel algorithm in complexity class.
5. To understand the recent applications of Parallel algorithms.

Course Outcomes :

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

1. Explain key concepts in parallel computational models.
2. Describe parallel algorithms, architectures and applications.
3. Implement different parallel algorithms, techniques and architectures.
4. Explain graph algorithms.
5. Understand dynamic programming strategy and its applications.

UNIT – I INTRODUCTION**8 Hours**

Introduction and motivation: key concepts, performance metrics, scalability and overheads. Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT - II CLASSIFICATION OF ALGORITHMS**8 Hours**

Classification of algorithms, architectures and applications: searching, divide and conquer, data parallel. Static and dynamic, message passing and shared memory, systolic Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost-optimality, an example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

UNIT - III PARALLEL SORTING NETWORKS**8 Hours**

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array Sorting and searching algorithms: merge sort, quicksort and bitonic sort, implementation on different architectures. Parallel depth-first and breadth-first search techniques.

UNIT - IV PARALLEL SEARCHING ALGORITHM**6 Hours**

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding. Matrix algorithms: striping and partitioning, matrix multiplication, linear equations, eigenvalues, dense and sparse techniques, finite element and conjugate gradient methods.

UNIT - V GRAPH ALGORITHMS**6 Hours**

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derangements.

Optimization: graph problems, shortest path and spanning tree

UNIT - VI DYNAMIC PROGRAMMING**6 Hours**

Dynamic programming, knapsack problems, scheduling. Element methods.

Synthesis of parallel algorithms: algebraic methods, pipelines, homomorphism.

Text Books

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Second Edition, Addison Wesley, 2003. ISBN: 0-201-64865.
2. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

Reference Books

1. S.G. Akl, "Parallel Sorting Algorithm" by Academic Press
2. F.T.Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California, 1992.
3. Wilkinson, M.Allen, "Parallel Programming Techniques and Applications using networked workstations and parallel computers", Prentice Hall, 1999.
4. Michael J. Quinn, "Parallel Computer Theory and Practice", McGraw Hill, Second Edition, 1994.

414456 E - ELECTIVE I : CLOUD COMPUTING**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

Phase I – 30 Marks

End-Semester Assessment

Phase II – 70 Marks

Prerequisites : Operating System, Computer Networks, Web Technologies**Course Objectives :**

1. To know the emerging trends in Cloud Computing.
2. To have thorough knowledge of Virtualization Technologies and Cloud architecture.
3. To integrate security in cloud applications.
4. To have systematic knowledge of Ubiquitous Computing.

Course Outcomes :

1. Understand and Familiar with the basic concepts of cloud computing.
2. Understand how to build large scale distributed systems and cloud applications.
3. Comprehend the importance of cloud security.
4. Understand Ubiquitous Computing and applications.

UNIT – I INTRODUCTION TO CLOUD COMPUTING**6 Hours**

Defining Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multitenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines.

UNIT - II VIRTUALIZATION, SERVER, STORAGE AND NETWORKING**6 Hours**

Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, HyperV Different hypervisors and features.

UNIT - III MONITORING AND MANAGEMENT**6 Hours**

An architecture for federated cloud computing, SLA management in cloud computing: Service provider's perspective, performance prediction for HPC on Clouds, Monitoring Tools.

UNIT - IV SECURITY**6 Hours**

Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor.

UNIT - V CLOUD IMPLEMENTATION AND APPLICATIONS**6 Hours**

Cloud Platforms: Amazon EC2 and S3, Cloudstack, Intercloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.

UNIT - VI UBIQUITOUS COMPUTING**6 Hours**

Basics and Vision, Applications and Requirements, Smart Devices and Services, Human Computer Interaction, Tagging, Sensing and controlling, Context-Aware Systems, Ubiquitous Communication, Management of Smart Devices, Ubiquitous System Challenge and outlook.

Text Books

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley
2. Gautham Shroff, "Enterprise Cloud Computing", Cambridge.
3. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions" by John Wiley & Sons, 2011.
4. A.Shrinivasan, J.Suresh, "Cloud Computing: A practical approach for learning and implementation", Pearson.

Reference Books

1. Rajkumar Buyya, J.Broberg, A. Goscinski, "Cloud Computing Principles and Paradigms", Wiley.
2. Ronald Krutz,"Cloud Security: Comprehensive guide to Secure Cloud Computing", Wiley Publishing.
3. Anthony T. Velte, "Cloud Computing: Practical Approach", McGraw Hill.
4. Tim Mather, "Cloud Security and Privacy", O'REILLY.

414457 A - ELECTIVE II : BUSINESS INTELLIGENCE**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

End-Semester Assessment

Phase I – 30 Marks

Phase II – 70 Marks

Prerequisites: Database Management System.**Course Objectives :**

1. This course focuses on how to design and build a Business Intelligence solution.
2. Students will also learn how to design and build a data warehouse within the context of student BI projects.
3. Students can develop their own projects within collaborative teams or be assigned an existing data source to develop a project.
4. To ensure success during the implementation phase, students will plan for and gather business requirements, as well as design the data warehouse in order to develop an effective BI plan.

Course Outcomes :

1. Design and implement OLTP, OLAP and Warehouse concepts.
2. Design and develop Data Warehouse using Various Schemas & Dimensional modelling.
3. Use the ETL concepts, tools and techniques to perform Extraction, Transformation, and Loading of data.
4. Report the usable data by using various reporting concepts, techniques/tools, and use charts, tables for reporting in BI.
5. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
6. Demonstrate application of concepts in BI.

UNIT - I IMPORTANT CONCEPTS**6 HOURS**

Introduction to Data, Information, and Knowledge, Design and implementation aspect of OLTP, Introduction to Business Intelligence and Business Models, Design and implementation aspect of OLAP/Data Warehouse, BI Definitions & Concepts, Business Applications of BI, Role of DW in BI, BI system components, Components of Data Warehouse Architectures.

UNIT - II DIMENSIONAL MODELLING AND DW DESIGN**6 Hours**

Star schema, Snow flake schema, and Fact Constellation schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions) Clickstream Source Data (Google Analytics as a Clickstream Data Source), Facts (additive, semi-additive, non-additive), Hierarchy in dimensions, parent child relationships, Many-Many Dimensional relationship, Multi Valued Dimensions and Dimension Attributes.

UNIT - III ETL**6 Hours**

Data Quality, Data profiling, Data enrichment, data duplication, ETL Architecture and what is ETL, Extraction concept and Change data capture, Transformation concept, lookups, time lag, formats, consistency, Loading concept, Initial and Incremental loading, late arriving facts, What is Staging, Data marts, Cubes, Scheduling and dependency matrix.

UNIT - IV REPORTING**6 Hours**

Metadata Layer, Presentation Layer, Data Layer, Use of different layers and overall Reporting architecture, Various report elements such as Charts, Tables, prompts Data aggregation: Table based, Materialized views, Query rewrite, OLAP, MOLAP, Dashboards, Ad-hoc reports, interactivity in analysis (drill down, drill up), Security: report level, data level (row, column), Scheduling.

UNIT - V ANALYTICS**6 Hours**

Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques:- Cluster analysis, Data visualization, Predictive analysis :- Regression, Time series, Data Mining :- Hierarchical clustering, Decision tree Text analytics :- Text mining, In-Memory Analytics and In-DB Analytics, Case study: Google Analytics

UNIT - VI RECENT TRENDS**6 Hours**

Big data like HIVE, PIG and DW appliances like Netezza, Teradata, Smart Change data capture using log based techniques, Real time BI, Operational BI, Embedded BI, Agile BI, BI on cloud, BI applications (Case study on BI tools like: QlikView, Pentaho, Tableau, MyReport, Spotfire, OR any other BI tool).

Text Books

1. Reema Thareja, "Data Warehouse", Publisher: Oxford University Press.
2. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining: concepts and techniques", 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.
3. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit", 3rd edition, Publisher: Wiley

Reference Books

1. William Inmon, "Building the Data Warehouse", Wiley publication 4th edition.
2. Efram G. Mallach, "**Decision Support And Data Warehouse Systems**", 1st Edition Publisher: Tata McGraw-Hill Education,. ISBN-10: 0072899816.
3. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "**Business Intelligence**", ISBN-10: 013610066X Publisher: Prentice Hall. ISBN-13: 9780136100669.
4. Dorian Pyle, "Business Modeling and Data Mining", Elsevier Publication MK.

414457 B - ELECTIVE II : SERVICE ORIENTED ARCHITECTURE**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites:** Web Engineering and Technology.**Course Objectives :**

1. Understand the concepts of Service Oriented Architecture along with the evolution of SOA.
2. Be aware of the key issues facing many organizations, especially dealing with integration among systems and providing architectural abstractions to them.
3. Integrate SOA technologies with Web Services paradigms.
4. Know related technologies and implementation basics of SOA.

Course Outcomes :

1. Students will be able to know the importance of SOA.
2. Students will be able to know SOA primitives.
3. Students will be able to analyze quality web services.
4. Students will be able to design and develop web services.

UNIT - I INTRODUCTION TO SOA**6 Hours**

Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, Comparing SOA with N-tier architecture, The continuing evolution of SOA, The roots of SOA.

UNIT - II WEB SERVICES AND PRIMITIVE**6 Hours**

Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP.

Web Services and Contemporary SOA: Message exchange patterns- Service activity coordination- Atomic transactions- Business activities-Orchestration-Choreography.

UNIT - III SERVICE ORIENTATION AND SECURITY**6 Hours**

Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies Metadata exchange- Security- Notification and eventing. SOA and Service-Oriented: Principles of Service-Oriented-Service-orientation. Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation.

UNIT - IV BUILDING SOA**6 Hours**

SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA Deriving business services- Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT - V SERVICE-ORIENTED DESIGN**6 Hours**

Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SOA Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT - VI RECENT TRENDS IN SOA**6 Hours**

Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics WS Coordination, QoS Compliance in SOA governance, Mapping of SOA and Cloud Computing, Case Study: Travel Insurance.

Text Books

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology & Design", Pearson Education Pte Ltd 2008
2. Michael Rosen, Boris Lublin sky, Kevin T. Smith, Marc J. Balcer, "Applied SOA: Service Oriented Architecture and Design Strategies", Wiley, 2010.

Reference Books

1. Thomas Erl, "SOA Principles of Service Design" Pearson Exclusives 2007.
2. Tomas Erl and Grady Booch, "SOA Design Patterns" Prentice Hall 2008.111.
3. David S. Linthicum, "Cloud Computing and SOA Convergence in Your Enterprise", Pearson Addison-Wesley Information Technology Series.
4. Shankar Kambhampaty, "Service Oriented Architecture – for enterprise and cloud applications", Wiley Second Edition.
5. Douglas K. Barry, "Web Services, Service-Oriented Architectures, and Cloud Computing", Elsevier, 2003.
6. James Bean, "SOA and Web Services Interface Design: Principles, Techniques and Standards", Elsevier, 2010.

414457 C - ELECTIVE II : E & M GOVERNANCE**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites :** Information Technology Project Management**Course Objectives :**

1. To understand What E-Commerce and M-Commerce is.
2. To study application of E-Commerce and M-Commerce.
3. To learn business models and governance structures in E & M Governance.
4. To study the effects of Information Technology on E & M Governance.
5. To learn mobile commerce technologies and to apply the same on E-Markets.

Course Outcomes :

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

1. Explain what E & M Governance is.
2. Understand the consequences of E-Commerce and M-Commerce.
3. Describe E-Procurements and E-Business Networks.
4. Define E-Commerce and M-Commerce services for consumers and businesses.
5. Understand E & M Governance standards and service development technology in M-Commerce.

UNIT - I INTRODUCTION TO E-BUSINESS**6 Hours**

e-Business: e-Business vs e-Commerce, Some critical factors, Characteristics of e-Business, Elements of an e-Business solution, e-Business roles and their challenges, e-Business requirements, Impacts of e-Business, Inhibitors of e-Business,

e-Business Strategy: Strategic positioning, Levels of e-Business strategy, The changing competitive agenda: business and technology drivers, The strategic planning process, Strategic alignment

The consequences of e-Business: theoretical foundations, Success factors for implementation of e-Business strategies

UNIT - II BUSINESS MODELS AND E-BUSINESS RELATIONSHIPS**6 Hours**

Pressures forcing business changes, Business models – definitions, Classifications of business models, Towards networked business models.

Modeling interdependent business activities: the value chain, Business processes and their management

Types and characteristics of e-Business relationships, Electronic links and the value chain.

UNIT - III GOVERNANCE STRUCTURES**6 Hours**

Markets versus hierarchies: theoretical contributions, The transaction cost perspective, Networks, A supply chain perspective: value-adding partnerships.

The effects of information technology on governance: e-Business Technological Infrastructure

Technical e-Business challenges, Basic infrastructure: client/server technology, Web technologies and applications, Collaborative technologies, The role of Enterprise Information Systems in e-Business

UNIT - IV E-MARKETS and E-PROCUREMENT**6 Hours**

Electronic markets defined, The functions of electronic markets, electronic markets versus traditional markets? Effects of electronic markets, Electronic market success factors, e-Market technology solutions

E-procurement: The purchasing process, Developments in purchasing, IT and purchasing, e-Procurement.

E-Business Networks: Network organizations, Inter organizational information systems and network organizations, Supply chains and Integrated supply chains.

UNIT - V MOBILE COMMERCE OPPORTUNITIES**6 Hours**

Mobile and Personal: The Emerging Mobile Lifestyle, Network Effects, Market Drivers, Beyond E-commerce.

Types of Mobile Commerce Services : Base Services Platform, Mobile Commerce Services for Consumers, Mobile Commerce Services for Businesses,

UNIT - VI MOBILE COMMERCE TECHNOLOGIES**6 Hours**

Network Technologies, Mobile Devices, Service Development Technology, Mobile Commerce-Enabling Standards, Live Issues

Text Books

1. Michael P. Papazoglou, Pieter Ribbers, "e-Business: Organizational and Technical Foundations", ISBN: 978-81-265-0796-2, Publisher: Wiley
2. Paul May , "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" ISBN: 978-0-521-79756-6, Cambridge University Press

Reference Books

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, E-Commerce: Fundamentals and Applications, ISBN: 978-0-471-49303-7, Publisher: Wiley
2. David Whiteley, E-Commerce: Strategy, Technologies and Applications, Tata McGraw Hill
3. Ravi Kalakota, Andrew Whinston, " Frontiers of Electronic Commerce", Addison Wesley Denial Amor " The E Business revolution", Addison Wesley
4. Sokol, "From EDI to Electronic Commerce: A Business Initiative", TMH
5. Bajaj Nag, "E Commerce : The Cutting Edge of Business", TMH
6. Bharat Bhasker, "Electronic Commerce Framework, Technologies and Applications", ISBN-13: 978-1-25-902634-3, McGraw Hill Education.

414457 D - ELECTIVE II : GEO-INFORMATICS SYSTEMS

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks

Prerequisites: Database Management System, Computer Graphics.

Course Objectives :

1. To understand geographical Information system and its applications.
2. To understand sensing mechanism of different satellites.

Course Outcomes :

1. Students will understand basics of Remote Sensing & GIS.
2. Students will able to analyze GIS data and GIS applications.

UNIT – I INTRODUCTION TO GEO-INFORMATICS AND GIS

6 Hours

Geo-Informatics: Introduction, Components of Geo-Informatics, Development and applications of remote sensing technology.

GIS: Definition, evolution, components, approaches, Geospatial data, GIS operations.

GIS architecture, models of GIS, framework for GIS, GIS categories, level / scales of measurement. types of map, spatial referencing system, map projections, grid systems, computer in map production.

UNIT – II FOUNDATIONS OF REMOTE SENSING

6 Hours

Basic Principles of remote sensing, Electromagnetic remote sensing process, Microwave Remote Sensing: The radar Principle, factors affecting microwave measurements, radar wavebands, Side-Looking Airborne Radar (SLAR) Systems, Synthetic Aperture Radar (SAR), Interpreting SAR images, geometrical Remote Sensing platform and Sensors: Satellite system parameters, sensor parameters, imaging sensor systems, Earth resources satellite series. linkage of GIS to remote sensing

UNIT – III DIGITAL IMAGE PROCESSING FUNDAMENTALS

6 Hours

Visual Image Interpretation: Types of pictorial data products, image interpretation strategy, image interpretation process, basic elements of image interpretation.

Basic character of digital images, preprocessing, registration, enhancement, spatial filtering, transformations, classification,

UNIT – IV SPATIAL DATA MANAGEMENT

6 Hours

Existing GIS data, Metadata, conversion of existing data, creating new data, geometric transformations, Describing data quality and errors, Sources of errors in GIS, Finding and modeling errors in GIS, Managing GIS error, types of errors- RMS error, location error, topological error, spatial data accuracy. Attribute data in GIS, Spatial data processing.

UNIT – V DATA MODELING AND ANALYSIS

6 Hours

Data Exploration, types of data queries, Vector data analysis- buffering, overlay, distance measurement, pattern analysis, Raster Data analysis- different types of operations, comparison of vector and raster based data analysis. Basic elements of GIS modeling- Binary models, Index models, Process models.

UNIT – VI APPLICATIONS AND DEVELOPMENT**6 Hours**

Urban and Municipal Applications- introduction and methodology.

GIS implementation and Project Management – Software Engineering. as applied to GIS, GIS project planning, System Analysis and user requirements studies, geospatial database design methodology Intelligent Transport Systems (ITS) -Components of ITS, Architecture and integration with GIS, Analysis and visualizations of traffic data in GIS, Integration of GPS and GIS.

Open source GIS.

Text Books

1. M. AnjiReddi, "Remote Sensing and Geographical Information Systems", B. S. Publications, Third Edition, 2006, Second reprint 2009
2. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Fourth Edition, 2008

Reference Books

1. C.P.Lo, Albert K. W. Yeung, "Concept and techniques of Geographic Information Systems", PHI, Second Edition, 2007.
2. Lillesand, T. and Keifer R, ,1999: Remote sensing and Image Interpretation, Wiley, London
3. Peter A. Burrough, Rachael A. McDonnell" Principles of Geographical Information Systems", Oxford University Press.

414457 E - ELECTIVE II : NATURAL LANGUAGE PROCESSING**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

Phase I – 30 Marks

End-Semester Assessment

Phase II – 70 Marks

Prerequisites : Basic understanding of probability theory, Theory of Computer Science, Systems Software

Course Objectives :

1. Understand the core concepts of Natural language processing and levels of language analysis.
2. Learning state of art NLP research areas such as parsing algorithms, ambiguity resolution and machine translation.

Course Outcomes :

1. Automatic processing and information extraction of human language using computer.
2. Learn applications of Natural Language Processing such as Information extraction, semantic web search, machine translation, text summarization, spam detection.

UNIT - I INTRODUCTION TO NATURAL LANGUAGE UNDERSTANDING**6 Hours**

The Study of Language Applications of Natural Language Understanding Evaluating Language Understanding Systems The Different Levels of Language Analysis, Representations and Understanding The Organization of Natural Language Understanding Systems.

UNIT - II LINGUISTIC BACKGROUND: GRAMMARS AND PARSING**6 Hours**

An Outline of English Syntax Words- The Elements of Simple Noun Phrases Verb Phrases and Simple Sentences Noun Phrases Revisited Adjective Phrases Adverbial Phrases, Grammars and Sentence Structure What Makes a Good Grammar A Top-Down Parser A Bottom-Up Chart Parser Top-Down Chart Parsing Finite State Models and Morphological Processing Grammars and Logic Programming Parsing tools such as Stanford Parser.

UNIT - III FEATURES AND AUGMENTED GRAMMARS**6 Hours**

Feature Systems and Augmented Grammars Some Basic Feature Systems for English Morphological Analysis and the Lexicon A Simple Grammar Using Features Parsing with Features, Augmented Transition Networks Definite Clause Grammars Generalized Feature Systems and Unification Grammars.

UNIT - IV TOWARD EFFICIENT PARSING**6 Hours**

Human Preferences in Parsing Encoding Uncertainty: Shift-Reduce Parsers Statistical Methods-Basic Probability Theory Estimating Probabilities Part-of-Speech Tagging Obtaining Lexical Probabilities Probabilistic Context-Free Grammars Best-First Parsing A Simple Context- Dependent Best-First Parser.

UNIT - V SEMANTIC INTERPRETATION AND AMBIGUITY RESOLUTION**6 Hours**

Semantics and Logical Form Word Senses and Ambiguity The Basic Logical Form, Language Encoding Ambiguity in Logical Form Verbs and States in Logical Form Case Relations. Representation of meaning – model theoretic representation, description logic, Lexical Resources such as WordNet, Semantic web Ontologies.

UNIT - VI APPLICATIONS AND RECENT TRENDS IN NLP**6 Hours**

Information Extraction, Question answering, Machine Translation, MT evaluation tools such as Bleu,

(word error rate) WER etc. Automatic text summarization, Sentiment Speech Recognition, Semantic web search, Automatic text Clustering.

Text Books

1. James Allen, "Natural Language Understanding", Pearson Publication, ISBN: 978-81-317-0895-8 2nd Edition
2. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education, 2002.

Reference Books

1. Christopher D. Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts, 1999.
2. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval
3. Daniel M.Bikel, ImedZitouni, Multilingual Natural Language Processing Applications

414458 : SOFTWARE LABORATORY – III**Teaching Scheme:**

Practical : 4 Hours/Week

Examination Scheme:

Term Work : 50 Marks

Oral : 50 Marks

Prerequisites: Knowledge of any Programming Language (Preferably Java).**Course Objectives :**

1. To Understand the Security issues in networks and Applications software.
2. To understand the machine learning principles and analytics of learning algorithms.

Course Outcomes :

1. The students will be able to implement and port controlled and secured access to software systems and networks.
2. The students will be able to build learning software in various domains.

Contents**PART A : Cyber Laws and Information Security****Section A** Programming

1. Write program in C++ or Java to implement RSA algorithm for key generation and cipher verification
2. Develop and program in C++ or Java based on number theory such as Chinese remainder or Extended Euclidean algorithm. (Or any other to illustrate number theory for security)
3. Write program in C++ or Java to implement Diffie Hellman key exchange algorithm.

Section B Cryptography Library (API)

1. Write a program in C++, C# or Java to implement RSA algorithm using Libraries (API).
2. Write a program in C++, C# or Java to implement SHA-1 algorithm using Libraries (API).

Section C Security Tools (Minimum one)

1. Configure and demonstrate use of IDS tool such as snort.
2. Configure and demonstrate use of vulnerability assessment tool such as NNESSUS
3. Implement web security with Open SSL tool kit

Students should submit the term work in the form of a journal. Each assignment has to be well documented with problem definition, theory and code documentation. Staff in charge will assess the assignments continuously and grade or mark each assignment on completion date, declared for each assignment.

Note: Oral examination will be based on the term work submitted by the student and the associated theory of the subject.

Reference Books

1. William Stallings, "Computer Security: Principles and Practices", Pearson Ed. ISBN: 978-81-317-3351-6.
2. Mark Merkow, "Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7.
3. CK Shyamalaet el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
4. BerouzForouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN: 9780070702080.

PART B : Machine Learning

GUIDELINES FOR STUDENTS AND TEACHERS:

Experiments should be performed with WEKA or R. Students are also encouraged to implement the experiments with **Java 1.6 and higher version (RJava Package)**. Standard Data Sets available on line may be used. A few popular data sets are :

- 1) Olive Oil Data Set 2) Iris Data Set 3) UC Irvine ML Laboratory

#Create your own dataset from domain of your interest.

- 1) Minimum five experiments are to be performed by group of two students.
- 2) Assignment numbers 1, 2 and 3 are compulsory.
- 3) Any two assignments should be chosen from the remaining list.
- 4) Journal must be maintained and submitted by each student for all the four assignments.
- 5) Subject Teachers should encourage students to use the same DATA-SET (or subset of it as per the requirement) to perform all tasks.

REFERENCE : 1) Open source software-WEKA or R 2) JAVA 6.1 or more (for RJava Package)
Subject teachers are advised to frame proper assignment statements from the following list.

LIST OF ASSIGNMENTS:

- 1) **Study of platform for Implementation of Assignments**
 Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA or R or Rjava.
- 2) **Supervised Learning - Regression**
 Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set.
 - i) Perform linear regression analysis with Least Squares Method.
 - ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.
 - iii) Verify the Effect of Data Set Size and Bias-Variance Tradeoff.
 - iv) Apply Cross Validation and plot the graphs for errors.
 - v) Apply Subset Selection Method and plot the graphs for errors.
 - vi) Describe your findings in each case.

3) Supervised Learning - Classification

Implement Naïve Bayes Classifier and K-Nearest Neighbor Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.

4) Unsupervised Learning

Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.

5) Dimensionality Reduction

Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.

6) Supervised Learning and Kernel Methods

Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non separable Dataset.

Reference Books

1. Open source software-WEKA or R.
2. JAVA 6.1 or more (for RJava Package).
3. Dr. Mark Gardener, Beginning R The Statistical Programming Language, ISBN: 978-81-265-4120-1, Wiley India Pvt. Ltd.
4. Jason Bell, "Machine Learning for Big Data Hands-On for Developers and Technical Professionals", ISBN: 978-81-265-5337-2-1, Wiley India Pvt. Ltd.

Term work:

Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

414459 : SOFTWARE LABORATORY – IV**Teaching Scheme:**

Practical : 4 Hours/Week

Examination Scheme:

Practical : 50 Marks

Oral : 50 Marks

Prerequisites: Problem Solving and Object Oriented Paradigm, Software Engineering.

Course Objectives :

1. Prepare an analysis model of a system using UML 2 diagrams.
2. Implement an appropriate design pattern to solve a design problem.
3. Understand a test driven development approach for coding.
4. Understand Object Oriented Software Development life cycle activities.

Course Outcomes :

1. Students will be able to identify classes and collaboration from requirements.
2. Students will be able to prepare analysis and design model and implement.
3. Students will be able to use the test driven development approach in implementation.
4. Students will be able to experience Object Oriented Software Development life cycle activities.

Contents

The laboratory will be in form of assignments. Each assignment will have a laboratory pre work.

Following are the guidelines to conduct the laboratories.

1. **Purpose: Understanding the implementation details of relationships among classes**
 Lab pre work: Prepare a class diagram from the given problem description using UML2.0 notations.
 Laboratory work: Implement the class diagram with a suitable object oriented language.
2. **Purpose: Implementation of a design model**
 Lab pre work: Prepare a design model from analysis model in the form of UML 2 class diagram.
 Laboratory work: Implement the design model with a suitable object oriented language
3. **Purpose: Implementation of a state model from the given description.**
 Lab pre work: Prepare a state model from the given problem description and draw a state diagram using UML2 notations
 Laboratory work: Implement the state model with a suitable object oriented language
4. **Purpose: Preparing an interaction model from the given details**
 Prepare a use case model, sequence model and activity model from the given description using UML 2 notations.
5. **Purpose: Implement a Strategy design pattern**
 Map the participants for the strategy design pattern from a given problem description and implement with a suitable object oriented language
6. **Purpose: Implement a State design pattern**
 Map the participants for the state design pattern from a given problem description and implement with a suitable object oriented language
7. **Purpose: Understand the concept of Test driven Development**
 Implement a design level class diagram (given as an input) with Test Driven Development approach.
8. **Objective: Understand and implement the Concept of a reusable component**
 Implement a reusable component in form of jar file (or in equivalent form for other OO languages). Use this component in a separate client implementation by importing the component as a jar file (or equivalent form for other OO language).

Reference Books

1. Software Architecture: Foundations, Theory and Practice by Richard N. Taylor, NenadMedvidovic, Eric M. Dashofy, Wiley India Pvt. Limited, 2010,
2. Software design: from programming to architecture, by Eric J. Braude, J. Wiley, 2004.
3. Pattern oriented software architecture: a pattern language for Distributed Computing, by By Fran Buschmann, Kelvin Henney, Douglas C Schmid, Wiley India Pvt. Limited volume-4.

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

414460 : PROJECT PHASE - I**Teaching Scheme:**

Tutorial : 2 Hours/Week

Examination Scheme:

Term work : 50 Marks

Prerequisites:Project Based Seminar.**Course Objectives :**

1. The practical implementation of theoretical knowledge gained during the study from FE to TE.
2. The student should be able implement their ideas/real time industrial problem/ current application of their engineering branch which they have studied in curriculum.
3. To build confidence in the student what he has learnt theoretically.
4. The dependent study of the state of the art topics in a broad area of his/her specialization.

Course Outcomes :

At the end of this course the student should be able to show preparedness to study independently in chosen domain of Information Technology and programming languages and apply to variety of real time problem scenarios.

Contents

Project Based Seminar (PBS) helped students to gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal in third year as part of course **314456 : Seminar & Technical Communication Laboratory**. They also submitted a technical report summarizing state-of-the-art on an identified topic.

B.E. Projects can be two types: Projects based on implementation of any application oriented problem, which will be more or less experimental in nature, and the others will be based on some innovative/ theoretical work.

In Project Phase-I the student will undertake same project over the academic year, which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering. In some cases; if earlier identified project is not feasible; a new topic must be formulated in consultation with the guide and project coordinator.

The project will be undertaken preferably by a group of **3-4 students** who will jointly work and implement the project. The group will select a project with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.

Review Committee:

The Head of the department/Project coordinator shall constitute a review committee for project work for project group; project guide would be one member of that committee by default. There shall be at least two reviews in semester-I and semester-II by the review committee. The students or project group shall make presentation on the progress made by them before the committee. The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination.

Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.

Semester - I

Review 1: Finalization of scope – the objectives and scope of the project should be finalized in second week of their academic semester. Should finalize list of required hardware, software or other equipment for executing the project, test environment/tools.

Review 2: Finalization of SRS – High level design, planning with CPM/PERT chart etc in the sixth week of their academic semester.

Semester – II

Review 3: Implementation Status and testing document.

Review 4 : Final Project Demonstration, Project Report and proper Result analysis

Guidelines for Students and Faculty:**Project Review Committee:**

1. This committee will be responsible for evaluating the timely progress of the projects and communicating the progress report to the students.
2. As far as possible Students should finalize the same project title taken for Project Based Seminar (PBS).
3. Review committee should conduct “Feasibility Review” in first week after commencement of the term. Review committee should finalize the scope of the project.
4. If change in project topic is unavoidable then the students should complete the process of project approval by submitting synopsis along with the review of important papers. This new project topic should be approved by review committee.

Term Work:

1. The term work will consist of a report prepared by the student on the project allotted to them.
2. They should use appropriate tools for the preparation of the report like project planning, UML diagram, testing tools, referencing tools etc.

Report Structure

- Contents
- List of Abbreviations
- List of Figures
- List of Graphs
- List of Tables
 1. Introduction and aims/motivation and objectives
 2. Literature Survey
 3. Problem Statement
 4. Project Requirements
 5. System Analysis Proposed Architecture/ high level design of the project
 6. Verification Validation
 7. Project Plan
 8. Conclusion
- References
- Appendices
 - A. Base Paper(s)

B. Plagiarism Report from any open source**Evaluation Guidelines:**

A panel of examiner will evaluate the viability of project / project scope. The panel will also verify that all the suggestions/comments in the review document are taken care and accordingly allot the term work marks. Oral examination in the form of presentation will be based on the project work completed by the candidates. Preliminary report must also be presented during the oral examination.

SEMESTER - II

414461 : Distributed System

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

Phase I – 30 Marks

End-Semester Assessment

Phase II – 70 Marks

Prerequisites: Operating System, Computer Networks and Web Engineering & Technology.

Course Objectives :

1. To understand the fundamentals of distributed environment in complex application.
2. To get comprehensive knowledge of the architecture of distributed systems.
3. To make students aware about security issues and protection mechanism for distributed environment.

Course Outcomes :

1. Understand the principles and desired properties of distributed systems on which the internet and other distributed systems are based.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.
3. Recognize the inherent difficulties that arise due to distributed-ness of computing resources.
4. Identify the challenges in developing distributed applications.

UNIT - I INTRODUCTION

5 Hours

Introduction, Examples of distributed systems, Trends in distributed systems, Focus on Resource Sharing, Challenges.

System Models: Physical models, Architectural Models, Fundamental Models.

Case Study: The World Wide Web

UNIT - II COMMUNICATION

6 Hours

Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Multicast Communication, Network Virtualization: Overlay Networks,

Case Study: MPI

Remote Invocation: Request-reply Protocols, Remote Procedure Call, Remote Method Invocation,

Case Study: Java RMI

Indirect Communication: Group Communication, Publish-subscribe Systems, Message Queues, Shared Memory approaches.

UNIT - III MIDDLEWARE

6 Hours

Distributed Objects and Components: Introduction, Distributed Objects, Case Study: CORBA. From Objects to Components,

Case Studies: Enterprise JavaBeans and Fractal.

Web Services: Introduction, Web Services, SERVICE Descriptions and IDL for Web Services, A directory service for use with web services, XML security, Coordination of web services, Applications of Web Services.

Peer-To-Peer Systems: Introduction, Peer-to-peer middleware, Routing overlays Application,

Case Study: Squirrel.

UNIT - IV DISTRIBUTED ALGORITHMS

6 Hours

Time and Global States: Introduction, Clocks, Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States.

Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections, Coordination and Agreement in Group Communication, Consensus.

Replication: Introduction, System Model and the role of Group Communication, Fault-tolerant Services.

Case Study: Coda.

UNIT – V DISTRIBUTED STORAGE AND MULTIMEDIA SYSTEMS

6 Hours

Distributed File Systems: Introduction, File Service Architecture, Sun Network File System, and HDFS.

Name Services: Introduction, Name Services and the Domain Name System, Directory Services.

Case Study: 1. The Global Name Service, 2. The X.500 Directory Service.

Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource management, Stream Adaptation.

Case Study: BitTorrent and End System Multicast.

UNIT - VI SECURITY IN DISTRIBUTED SYSTEMS

7 Hours

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography.

Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,

Case Study: Kerberos.

Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service.

Security Management: Key Management, Secure Group Management, Authorization Management.

Emerging Trends In Distributed Systems: GRID COMPUTING, SOA, Cloud Computing.

Text Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, & Gordon Blair, "Distributed Systems – Concept and Design", 4th Edition, Publisher: Pearson.
2. Andrew S. Tanenbaum & Maarten van Steen", Distributed Systems – Principles and Paradigms", 2nd Edition, Publisher: PHI.
3. P. K. Sinha,"Distributed Operating Systems Concepts and Design", Publisher: PHI.

Reference Books

1. Sunita Mahajan, Seema Shah, "Distributed Computing", 2nd Edition, Publisher: Oxford University Press.
2. Advanced concepts in Operating Systems, Mukesh Singhal & N.G.Shivaratri, TMH.
3. Randay Chow, Theodore Johnson, "Distributed Operating System and Algorithm Analysis", Publisher: Pearson (LPE).
4. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnappalli, Niranjana Varadarajan, Srinivas Padmanabhuni, Srikanth Sunderrajan , " Distributed System Security: Issues, Processes and solutions", ISBN: 978-0-470-51988-2, Feb 2009, Publisher: Willey online Library.

414462 : Advanced Databases

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks

Prerequisites: Database Management System.

Course Objectives :

1. To learn and understand Database Modeling, Database Architectures.
2. To learn and understand Object Oriented Databases.
3. To learn and understand web database language, XML, JDOQL.
4. To learn NoSQL Databases (Open source) and big data analytics.
5. To learn Web data and mining.
6. To learn current trends in databases.

Course Outcomes :

1. Understanding of Advances in Database Architectures for Big data.
2. Master the basics of web and object oriented database using XML and JDOQL.
3. Master the basic concepts of NoSQL Databases.
4. Understand how analytics and big data affect various functions now and in the future.
5. Appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.
6. Understanding of current trends in databases.

UNIT - I PARALLEL AND DISTRIBUTED DATABASES

6 Hours

Parallel Database: Introduction, Architectures, Interquery and Intraquery Parallelism, Parallelism on Multicore processor, Parallel Query Optimization,

Distributed Database: Introduction, Data Storage, Distributed Transactions, Commit Protocol, Concurrency control, Distributed Recovery.

UNIT - II OBJECT-BASED DATABASE AND XML

6 Hours

Overview, Complex databases, Structured data types, operations on structured and unstructured data. Encapsulation and ADTs. Inheritance, Objects, OIDs and Reference types, Database Design, ORDBMS Implementation challenges-Storage and Access methods, Query Optimization, ODMS-Object model. NOSQL object database-ObjectDB (JDO),JDO Data Model, XML Data Model ,DOM, XQuery, Efficient evaluation of XML Queries.

UNIT - III BIG DATABASES

8 Hours

Introduction to Big Data, NoSQL database system – Columnbased and key value based

Column based Database (Cassandra) : Architecture, Managing data, Data Caching, Tuning, Data backup, Cassandra Query Language, CQL Data Model, Indexing

Key Value based Database (DynamoDB) : Data Model, Operations, Data Access, Indexing.

UNIT - IV BIG DATA ANALYTICS**8 Hours**

Introduction to data mining and analytics, Data Streams mining, Stream data management systems: Issues and solutions, Stream frequent pattern analysis, Stream classification, Stream cluster analysis, Graph based database, graph mining, Methods for Mining Frequent Sub graphs Mining Variant and Constrained Substructure Patterns, Social Network Analysis, Models of social network generation, mining on social network, Apache Flume NG - Microsoft StreamInsight as tools for Complex Event Processing (CEP) applications. Case Studies Big Data in E-Commerce and IT Energy Consumption, Social and Health Science.

UNIT - V MINING TEXT AND WEB**6 Hours**

Text mining : Introduction, natural language processing and information extraction: An Introduction Text categorization methods

Web Mining : Introduction, Web Contents and Usage, Data Modeling for Web Usage Mining, Mining Web linkage structures, **Discovery and Analysis of Web Usage Patterns**: Session and Visitor Analysis, Analysis of Sequential and Navigational patterns

Recommender Systems and Collaborative Filtering: The Recommendation Problem, Content-Based Recommendation, Collaborative Filtering using K-Nearest Neighbor KNN and Association Rules, Matrix Factorization.

UNIT - VI CURRENT TRENDS IN ADVANCED DATABASES**6 Hours**

Deductive Databases: Introduction, Semantics, Fix point operator, Safe data log programmers, Least Model, Least fixed point, Query Processing, Query Evaluation, Prototypes, and Deductive Vs RDBMS. Multimedia Database, Cloud Databases, Spatial Databases, Temporal Databases.

Text Books

1. Raghu Ramkrishanan, Johannes Gehrke 4th Edition "Database Management Systems"
2. Avi Silberschatz , Henry F. Korth , S. Sudarshan, "Database System Concepts, Sixth Edition", ISBN-13: 978-93-3290-138-4, MCGraw Hill

Reference Books

1. Shio Kumar Singh, Database Systems Concepts Design and Applications, ISBN- 978-81-317-6092-5, Pearson
2. Mario Piattini, Oscar Diaz "Advanced Database Technology and Design" - online book.
3. J. Han, M. Kamber Data mining: concepts and techniques. Morgan Kaufmann.
4. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer.
5. Big Data Black Book, DT Editorial Services, Wiley-Dreamtech Press, ISBN- 9789351197577, May 2015.
6. <http://nosql-database.org/>

414463 A - ELECTIVE III : MOBILE COMPUTING

Teaching Scheme:

Lectures: 3 Hours/Week
Practical: 2Hours /Week

Examination Scheme:

In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks Term work – 25 Marks Oral – 25 Marks
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Prerequisites: Computer Networks.

Course Objectives :

1. To understand the fundamentals involved in technologies of Mobile computing.
2. To study GSM Architecture and Services.
3. To learn about different architectures of mobile application development.
4. To know recent and future trends in mobile computing.

Course Outcomes :

1. Students will gain knowledge of GSM architecture.
2. Students will be able to understand mobility management.
3. Students will be able to understand working of wireless architectures and their applications.
4. Students will be able to understand recent trends and emerging technologies.

UNIT - I INTRODUCTION

6 Hours

Introduction – PCS Architecture, Cellular Telephony, Mobile Computing Architecture

Mobile devices: Device Overview, Input mechanism, Wireless communication, Mobile Device classification, Device Manufacturers

Mobile Generations: Devices and Applications for: 1G, 2G, 2.5G, 3G

Mobility Management : Handoff, Roaming Management, Roaming Management under SS7

Handoff Management : Handoff Detection, Strategies for Handoff Detection, Channel Assignment, Link Transfer Types, Hard Handoff, Soft Handoff

UNIT - II GSM AND MOBILITY MANAGEMENT

6 Hours

GSM System Overview: GSM Architecture, Data Services, Unstructured Supplementary Service Data

Mobility Management : GSM Location Update, Mobility Databases, Failure Restoration, VLR Identification Algorithm, VLR Overflow Control

UNIT - III GSM SERVICES

6Hours

GSM Service: SMS Architecture, SMS Protocol Hierarchy, Mobile-Originated Messaging, Mobile – Terminated Messaging

International Roaming for GSM: International GSM, Call Setup, Reducing the International Call Delivery Cost

Mobile Number Portability: Fixed Network Number Portability, Number Portability for Mobile Networks, Mobile Number Portability Mechanisms, Implementation Costs for Mobile Number

Mobile prepaid service: Wireless intelligent network approach, service node approach, hot billing approach, handset based approach

UNIT - IV GSM DATA LAYER**6 Hours**

General Packet Radio Service (GPRS): GPRS Functional Groups, GPRS Architecture GPRS Network Nodes, GPRS Interfaces, GPRS Procedures, GPRS Billing, Evolving from GSM to GPRS

Wireless Application Protocol (WAP): WAP Model, WAP Gateway, WAP Protocols WAP UAProf and Caching, Wireless Bearers for WAP, WAP Developer Toolkits, Mobile Station Application Execution Environment

Third-Generation Mobile Services: Paradigm Shifts in Third-Generation Systems W-CDMA and cdma2000, Improvements on Core Network, Quality of Service in 3G Wireless Operating System for 3G Handset

UNIT - V MOBILE APPLICATION ARCHITECTURES**6 Hours**

Choosing the right architecture: Application architecture, Device type, Enterprise connectivity, Enterprise data, Enterprise integration, User notification, security, battery life

Application Architectures: Wireless internet, Smart Client, messaging

Smart Client Overview: architecture

Smart Client Development process: Need analysis phase, design phase, implementation and testing phase, deployment phase

UNIT - VI RECENT AND FUTURE TRENDS**6Hours**

Android OS and its Architecture, Mobile Applications, User Interface design for mobile Applications, Managing Application Data, Performance, Scalability, Modifiability, Availability and Security of Mobile Applications, Testing Methodologies for Mobile Applications.

Future Mobile Generations: 4G, 5G

Note: Instructor should design at least 08 assignments of sufficient complexity on Mobile application Development (Unit VI) and 04 study assignments on Units I to V.

Text Books

1. Yi Bang Lin, "Wireless and Mobile Network Architectures", Wiley Publications.
2. Martyn Mallick, "Mobile and Wireless design essentials", Wiley Publications.

Reference Books

1. John Schiller, "Mobile communications", Pearson Publications.
2. Asoke Talukder and Roopa Yavagal", Mobile Computing Technology, Applications and Service Creation", Second Edition, ISBN-13: 978-0-07-014457-6, Tata McGraw Hill.
3. Iti Shah Mishra, "Wireless Communication and Networks 3G and Beyond", Second Edition, ISBN-13: 978-1-25-906273-5, McGraw Hill Education
4. Theodore S. Rappaport, "Wireless Communications principles and practice", 2nd edition, Pearson Education, ISBN – 978-81-317-3186-4.
5. Ke-Lin Du & M.N. S. Swamy, "Wireless Communication Systems, From RF Subsystems to 4G Enabling Technologies, ISBN: 978-0-521-18736-7, Cambridge University Press,

414463 B - ELECTIVE III : ADVANCED GRAPHICS AND ANIMATION**Teaching Scheme:**

Lectures: 3 Hours/Week
 Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks
	Term work – 25 Marks
	Oral – 25 Marks

Prerequisites :

1. Knowledge of C++ or linear algebra.
2. Computer Graphics, Multimedia Systems.
3. Strong software Engineering Skills.

Course Objectives :

1. Provide solid grounding in three dimensional modeling mechanisms.
2. Introduce students to techniques in virtual reality, solid modeling and animation
3. To gain first-hand experience for accurate modeling, rendering, and simulation, and the necessary data structures and algorithms.
4. To develop programming skills in 3D computer graphics.
5. Become acquainted with some advanced topics in computer graphics.

Course Outcomes :

At the end of this course students should be able to

1. Learn recent methods in rendering, modeling, and animation.
2. Understand the current models for the interaction of light and materials
3. Understand some areas of current computer graphics research.
4. Learn and use the production pipeline to create your own animation

UNIT – I 3D MODELING AND 3D OBJECT REPRESENTATION**3 Hours**

Brief Review of 3D modeling and 3D object Representation 3D display methods, Polygon surfaces, polygon meshes, Curved lines and surfaces, Quadratic surfaces, Spline representation and specification B-Spline curves and surfaces.

UNIT - II SOLID MODELING**9 Hours**

Representing solids, Primitive instancing, sweep representations, Boundary representations, spatial-partitioning representations, constructive solid geometry, user interfaces for solid modeling, comparison of representations.

UNIT - III RENDERING**6 Hours**

Introduction, Basics of illumination and shading models, Transparency, Shadows and textures, Ray tracing from the light source, cone, beam and pencil tracing. Point based rendering, Mesh Simplification, Spatial partitioning, Solid Modeling,

UNIT – IV OpenGL**10 Hours**

OpenGL over windows, SDK, Extensions, GLUT, GLU, OpenGL primitives, Programming language: Blending, 3D Viewing (camera analogy), Lighting model, Culling, Fog, Texture mapping.
 OpenGL over Linux, pBuffer rendering, Shadowing Techniques, a few examples and demos of OpenGL programs.

UNIT - V ANIMATION**5 Hours**

Introduction, Devices for producing animation , Conventional and Computer assisted animation, Animation languages, Basic rules of animation, Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques , Programming aspects in creating simple animation

UNIT – VI VIRTUAL REALITY**3 Hours**

Basics, Devices for Virtual Reality, Virtual Reality Languages, Virtual Reality Design, Omegalib And Applications

Text Books

1. Donald Hearn & M. Pauline Baker, "Computer Graphics C version", 2nd Ed, Pearson Education.
2. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.
3. "OpenGL Programming Guide: The Official Guide to Learning OpenGL", Mason Woo, Jackie, Tom Davis, Version 2.1, 6th Edition, Pearson Education, ISBN 978-81-317-2184-1.

Reference Books

1. M.N. Sinha, A.D. Udai, "Computer Graphics", Tata McGraw Hill Edition.
2. Foley, Dam, Feiner, Hughes, "Computer Graphics Principles & Practice", 2nd Ed, Pearson Education.
3. Hill, Kelly, "Computer Graphics using OpenGL", 3rd Ed, Eastern Economy Edition.
4. "Advanced Animation and Rendering Techniques: Theory and Practice", Alan H. Watt and Mark Watt, Addison-Wesley, ACM Press, ISBN: 0201544121

Web-links

<http://nptel.ac.in/syllabus/106106090/>
<http://studentnet.cs.manchester.ac.uk/ugt/COMP37111/syllabus>
<http://www.sci.tamucc.edu/~sking/Courses/COSC5328/syllabus.php>

List of Practical

The lab course will be evaluated on the basis of five assignments framed by the faculty that primarily involve programming systems for rendering, simulation and animation concepts. These assignments need to be done individually by the students. Faculty can choose from the list below or frame new assignments based on the theory contents.

1. Implement an OpenGL program to draw different 2D shapes.
2. Implement an OpenGL program to draw 2 overlapped shapes and use alpha blending.
3. Implement an OpenGL program to draw 3D cube and apply transformations.
4. Implement an OpenGL program to draw 12 spheres and apply different light effects.
5. Implement an OpenGL program to draw scene and apply fog effect.
6. Implement an OpenGL program to draw 3D cube and apply different textures on different faces.
7. Program describing certain animation techniques like Basic Key-framing , Rigid Body Dynamics, Motion Capture (Can be implemented in the language / API of your choice)
8. Assignments based on virtual reality
9. Draw histogram of 256-color BMP image.

414463 C - ELECTIVE III : INFORMATION STORAGE AND RETRIEVAL**Teaching Scheme:**

Lectures: 3 Hours/Week
 Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks
	Term work – 25 Marks
	Oral – 25 Marks

Prerequisites:Data Structures and Files, Database management systems.

Course Objectives :

1. To understand information retrieval process.
2. To understand concepts of clustering and how it is related to Information retrieval.
3. To deal Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system.
5. TO understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes :

1. Student should be able to understand the concept of Information retrieval.
2. Student should be able to deal with storage and retrieval process of text and multimedia data.
3. Student should be able to evaluate performance of any information retrieval system.
4. Student should be able to understand importance of recommender system.
5. Student should be able to understand concept of multimedia and distributed information retrieval.

UNIT - I INTRODUCTION**8 Hours**

Basic Concepts of IR, Data Retrieval & Information Retrieval, IR system block diagram. **Automatic Text Analysis:** Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing, Automatic Classification. Measures of Association, Different Matching Coefficient, Classification Methods, Cluster Hypothesis, Clustering Algorithms, Single Pass Algorithm, Single Link Algorithm, Rocchio's Algorithm.

UNIT - II STORAGE AND SEARCHING TECHNIQUES**6 Hours**

Storage: Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files.

IR Models: Basic concepts, Boolean Model, Vector Model

Searching strategies: Boolean Search, Serial search, cluster based retrieval, Query languages, Types of queries, Patterns matching, structural queries.

UNIT - III RETRIEVAL PERFORMANCE EVALUATION AND ONTOLOGY**6 Hours**

Performance evaluation:Precision and recall, alternative measures

Ontology: Ontology based information sharing, Ontology languages for semantic web, Ontology creation.

UNIT - IV DISTRIBUTED AND MULTIMEDIA IR**6 Hours**

Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing, web issues.

MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two dimensional color images, Automatic feature extraction.

UNIT - V WEB SEARCHING**6 Hours**

Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Meta-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack, Searching using Hyperlinks, Page ranking algorithms.

UNIT - VI RECOMMENDER SYSTEMS**6 Hours**

Collaborative Filtering and Content Based Recommendation of Documents and Products, **Information Extraction and Integration:** Extracting Data from Text. Semantic Web, Collecting and Integrating Specialized Information on the web.

Text Books

1. Yates & Neto, "Modern Information Retrieval", Pearson Education, ISBN 81-297-0274-6.
2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk).
3. Heiner Stuckenschmidt, Frank van Harmelen, "Information Sharing on th Semantic Web", Springer International Edition, ISBN 3-540-20594-2.

Reference Books

1. Christopher D. Manning, PrabhakarRaghavan and HinrichSchutze"Introduction to Information Retrieval", Cambridge University Press, ISBN 978-0-521-86571-5
2. Mark Ieven, "Introduction to search engines and web navigation", John Wiley and sons Inc., ISBN 9780-170-52684-2.
3. V. S. Subrahmanian, Satish K. Tripathi "Multimedia information System", Kulwer Academic Publisher.
4. ChabaneDjeraba,"Multimedia mining A highway to intelligent multimedia documents", Kulwer Academic Publisher, ISBN 1-4020-7247-3.
5. Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.
6. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010.

List of Practical Assignments

Faculty member should frame 7-8 assignments of sufficient complexity and maintain a record of continuous assessment and should be produced at the time of practical/oral examination

414463 D - ELECTIVE III : IT ENABLED SERVICES

Teaching Scheme:

Lectures: 3 Hours/Week
Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites: Information Technology and Project Management, Web Engineering and Technology.

Course Objectives :

1. To understand importance of IT enabled services.
2. To encourage the use of Information Technology so as to enable students to improve their skills, knowledge and job prospects and enable them to obtain employment in sunrise industries.
3. To develop the ability to integrate various resources for optimization in the industry as well as for strategic utilization of IT enabled services and functions.

Course Outcomes :

1. Students will be able to understand the process of IT Industry
2. Students will be able to understand Indian laws of IT industry
3. Student will be able to study current trends and services in IT industry
4. Student will be able to understand programming concept of IT Web services.

UNIT - I BUSINESS STRATEGY: CHALLENGES AND OPPORTUNITIES FOR IT 6 Hours

Business Strategy: Challenges and Opportunities in the Globalized, Interconnected, Convergent World, Establish Principles before Practice, IT Strategy, Application Strategy, Technology Strategy for IT, IT Management Strategy, Developing IT Strategy for Competitive Advantage, Stages of IT Strategy Development and Implementation, Challenges of IT and Business Strategy Alignment, Inhibitors of Business and IT Strategy Alignment, Three-D Framework for Business and IT Strategy Alignment.

Unit – II STRATEGIC IT PLANNING 6 Hours

Business Implications for IT Strategic and Planning, Strategic IT Planning Motivations, SITP Process: Prevalent Planning Approaches, Difficulties in Developing and Executing SITP, Best Practices for Achieving Good SITP, SITP Approaches-Prevalent Researches.

UNIT - III ENTERPRISE IT ARCHITECTURE 6 Hours

Defining EITA, Contents of a Typical Enterprise IT Architecture, Standard for Enterprise IT Architecture, Technology Management strategy Framework, Prevalent Technology Reference Architectures Framework and Standards, Program Management, Benefits of PMO, Desired Qualities of a Program Office Manager, Maturity of PMO, Implementation of PMO Strategy, Measuring PMO Performance, Success Factors for PMO, Project Scope Management, PMO Dashboard and Reporting.

UNIT - IV IT SERVICE MANAGEMENT STRATEGY 6 Hours

Information Technology Infrastructure Library (ITIL), ITIL Overview, ITIL Service Support Processes, Incident Management, Problem Management, Service Delivery, Service Level Management, Financial Management, Capacity Management, IT Service Continuity Management (ITSCM), Availability Management, Imperatives for Outsourcing, IT Management Layers, Variants of Outsourcing, Business Process Outsourcing, In sourcing.

UNIT – V IT ENABLED WEB SERVICES**6 Hours**

Overview of basic features of PHP: arrays, functions and state management, working with PHP forms, More advanced PHP, OOP's concept in PHP, Portable database supported with different, exception handling, concepts of UDDI, WSDL, SOAP.

UNIT – VI CURRENT TRENDS IN ITES**6 Hours**

Current Employment in the IT and ITES industry: Newly emerging area and requirement of IT enabled service sector. Industry Oriented Human Resource Requirement: Outlook of the IT and ITES Industry. Barriers to Trade in ITES Role of International Bodies (WTO & UNCTAD) in facilitating Trade in ITES/ITES, experiences and Case studies of ITES-call centers, ERP, google.

Text Books:

1. Sanjiva Shankar Dubey, "IT strategy and Management", PHI.
2. K.Venkatesh, "Marketing of Information Technology", TMH.
3. Steve Suehring, Timconverse, Joyoe Park, "PHP 6 and MySQL Bible", Willey.

Reference Books:

1. Shiro Uesugi, "IT Enabled Services", Springer; 2013 edition, 2013.
2. Sanjiva Shankar Dubey, "IT Services Business Management: Concepts, Processes and Practices", PHI, 2012.
3. Nikhil Treebhohu, "Promoting IT Enabled Services", Addison-Wesley, 2013.

List of Practical Assignments

1. Create a Dynamic Calendar using PHP functions which allows the user to move the calendar forward or backward by a month at a time using simple XHTML form submit button.
2. Write a program to implement error handling in PHP.
3. Write a program to implement file handling in PHP including different file functions such as fwrite(), fgetss(), fpassthru(), file() etc.
4. Explore and implement WSDL document structure.
5. Write a program to implement WSDL in PHP using request and response operations and its types.
6. Write a program to implement a SOAP web service in PHP using request and response operations.
7. Write a program in Object Oriented PHP such that it will create the number of pages for a web site that will look and behave in same way and those pages should be able to modify to suit the different parts of the site.
8. Study a case study of Internet Banking web site or Indian Call Center for understanding the Architecture, Strategic IT Planning, Business Strategies – Challenges and Opportunities.
9. Study assignment on Information Technology Infrastructure Library (ITIL).

Note:

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Subject teacher may frame new assignments which will have equivalent the difficulty level.

Text Books:

1. IT strategy and Management by Sanjiva Shankar Dubey, PHI
2. PHP 6 and MySQL Bible, Steve Suehring, Timconverse, Joyoe Park, Willey.
3. PHP and MySQL Web Development by Luke Welling and Laura Thomson, SAMs Publishing.

414463 E - ELECTIVE III : ADVANCED COMPUTER NETWORKS**Teaching Scheme:**

Lectures: 3 Hours/Week
 Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks
	Term work – 25 Marks
	Oral – 25 Marks

Prerequisites: Fundamentals of Computer Network, Computer Network, Web Technologies.

Course Objectives :

1. To learn fundamental of computer network principles, services and architectures of various networks.
2. To introduce a set of advanced technologies in networking.
3. To learn advanced routing protocols and router architecture.
4. To gain knowledge of QoS and congestion control in end-to-end data transfer.
5. To introduce with a set of advanced Wireless Network standards and research in network.

Course Outcomes :

After successful completion of this course students will be able to:

1. Apply basic principles in designing modern computer networks.
2. Use functionality of high speed networks in development of advanced network applications.
3. Use advanced routing architecture and protocols in networking.
4. Apply performance measures for routing in computer networks.
5. Use advanced wireless standards in designing wireless networks.

UNIT - I FOUNDATION OF COMPUTER NETWORK**6 Hours**

Application, Requirements, Network Architecture, ISO-OSI, TCP-IP, Implementing Network Software, Performance, Perspective on Connecting, Encoding, Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Network, Wireless: 802.11a/b, 802.15.1 to 802.15.4, 802.16 (c-d), Cell Phone Technologies, Ad-hoc Networking: Model of operation, DoD Perspective, Internetworking: Switching and Bridging, Basic Internetworking, Routing, Implementation and Performance.

UNIT - II HIGH SPEED NETWORKS AND ADVANCED TECHNOLOGIES**6 Hours**

Frame Relay, ATM: Features, Addressing, Signaling, and Routing, ATM Header Structure, ATM Adaptation Layer, Management and Control, Internetworking with ATM, ISDN: Overview, Interface and function, ISDN layers, ISDN services, BISDN: Need, Functional Architecture, Optical Network: links, WDM system, Optical LANs, Optical paths and networks.

UNIT - III ADVANCED INTERNETWORKING**6 Hours**

Routing Areas, Inter-domain Routing (BGP Version 4), IPv6, Multicast Addresses and Routing Mechanism (DVMRP, PIM, MSDP), Integrated IS-IS, Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Among Mobile Devices Mobile IP, Virtual Private Network, VoIP Basics, Router Architectures: Shared CPU Architectures, Shared Forwarding Engine Architectures, Shared Nothing Architectures, Clustered Architectures.

UNIT - IV CONGESTION CONTROL, RESOURCE ALLOCATION AND END-TO-END DATA**6 Hours**

Issues in resource allocation, Queuing Disciplines: First-In, First-Out Queueing, Priority Queueing , Round-Robin and Fair Queueing, Weighted Round-Robin and Weighted Fair Queueing, Deficit Round-Robin Queueing, Modified Deficit Round-Robin Queueing, TCP Congestion Control: Additive

Increase/Multiplicative Increase, Slow Start, Fast Retransmit and Fast Recovery, Congestion Avoidance Mechanisms: DECBbit, RED, Source Based Congestion Avoidance, Traffic Policing, Quality of Service: Application Requirements, RSVP, EE, AF. Data Presentation Formatting: Taxonomy, XDR, ASN, NDB, Markup Languages, and Multimedia Data: Lossless Compression Techniques, Images Representation and Compression, Video Compression, Transmitting MPEG over Network, Audio Compression.

UNIT - V QUALITY OF SERVICE ROUTING

6 Hours

QoS attributes, Routing Protocol for QoS Routing, Traffic Engineering, Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching (MPLS), Generalized MPLS, MPLS Virtual Private Networks, and Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, and Routing/Traffic Engineering for Voice over MPLS.

UNIT - VI ADVANCED WIRELESS NETWORK STANDARDS

6 Hours

Advanced Wireless LAN Standards: 802.11g, 802.11n, 802.11ac-ax, Difference in between different 802.11 standards, WPAN: High Rate WPAN, Low Rate WPAN, IEEE 802.15.5, IEEE 802.15.6, IEEE 802.15.7, WiMAX: 802.16e to 802.16. 1a, Difference in between different 802.16 standards, Quality of Service in Wireless Networks, Research Trends in Wireless Networks.

Text Books

1. Larry L. Peterson, Bruce S. , "Computer Networks: A Systems Approach", 4th edition, Davie Publisher: Elsevier/Morgan Kaufmann, ISBN: 13:978-0-12-370548-8; 10:0-12-370548-7.
2. Jean Walrand and Pravin Varniya, "High Performance Communication Networks" second edition Publisher: Morgan Kaufmann Publisher Elsevier ISBN: 1-5580- 574-6 Indian ISBN: 81-8147-652-2.
3. Deepankar Medhi, Karthikeyan Ramasamy, "Network Routing Algorithms, Protocols, and Architectures", Publisher: Morgan Kaufmann Publisher Elsevier ISBN 13: 978-0-12-088588-6.
4. William Stallings, "Wireless Communications & Networks", 3rd Edition, Prentice Hall, ISBN-10: 0131918354.

Reference Books

1. Douglas E. Comer, "Internetworking with TCP/IP Vol -I", 5th Edition Publisher: Prentice Hall.
2. Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN: 978-0132-126953.
3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, 2004

414464 A - ELECTIVE IV : BIO INFORMATICS

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks

Prerequisites : Design and Analysis of Algorithms, Basic Concepts of Data Mining and Machine Learning.

Course Objectives :

1. To introduce students with Synthesis of DNA and RNA, major databases and applications in Bioinformatics along with classification schema.
2. Study of various data visualization and statistical techniques to discover new patterns in protein structure, through Clustering and Classification.
3. Study of various Data Mining and Pattern Matching techniques for knowledge discovery in Bioinformatics Databases through sequence alignment algorithms.
4. Analysis of various simulation tools in Bioinformatics for similarity search and study of prediction algorithms.
5. Study of Protein Structure Modeling and Simulation, drug discovery process.
6. To introduce students with the overview of Systems Biology and Human Disease.

Course Outcomes :

After successful completion of this course student will able to:

1. Understand basic DNA and RNA structure, features and classification schema for databases, applications in Bioinformatics.
2. Use various statistical concepts and visualization tools to discover new patterns in Protein Structures and analyze randomness in data.
3. Explore the various Bioinformatics Databases for knowledge discovery given by Data Mining and Pattern Matching techniques through study of various sequence alignment algorithms.
4. Offer appropriate solutions for similarity search through similarity search and prediction algorithms.
5. Understand modeling and simulation in bioinformatics with the help of simulation and statistical protocols, basic drug discovery process.
6. Gain awareness in field of Systems Biology and Human Disease.

UNIT - I INTRODUCTION

6 Hours

Introduction, Historical overview, Information Theory and Central Dogma of Molecular Biology, Bioinformatics Applications, Features and Classification Schema of Biological Databases, Protein Structure Classification Databases

UNIT - II DATA VISUALIZATION AND STATISTICS

6 Hours

Sequence Visualization, Structure visualization, Rendering Tools, Statistical Concepts, Micro arrays, Imperfect Data, Quantifying Randomness, Data Analysis, Tool selection for Statistical Analysis, Statistics of Alignment, Clustering and Classification

UNIT - III DATA MINING AND PATTERN MATCHING

6 Hours

Methods & Technology Overview, Infrastructure, Pattern Recognition & Discovery, Text Mining & Tools, Sequence alignment-Concept of alignment, Scoring matrices, PAM, BLOSUM, Alignment of pairs

of sequences, Alignment algorithms

UNITIV BIOINFORMATICS TOOLS AND ALGORITHMS

6 Hours

Introduction, Heuristic Methods for Sequence Alignment, Working with FASTA, Working with BLAST, FASTA & BLAST Algorithms & Comparison, Introduction to Phylogenetic, Prediction algorithms for Genes and Phylogenetic

UNIT - V PROTEIN STRUCTURE MODELING, SIMULATION AND DRUG DESIGN

6 Hours

Methods for Protein Modeling, Homology or Comparative modeling, Model refinement and Evaluation, Tools for Modeling and Simulation, Drug Discovery Process, Structural Bioinformatics in Drug Discovery, Simulation and Statistical Protocols of Markov Chain and Hidden Markov Model

UNIT - VI RECENT AND FUTURE TRENDS IN BIOINFORMATICS

6 Hours

Systems Biology in Human Health and Disease and Future of Medicine

Text Books

1. S.C.Rastogi, N.Mendiratta, P.Rastogi 'Bioinformatics-Methods & Application Genomics, Proteomics and Drug Discovery', Third Edition, Prentice Hall of India.
2. Bryan Bergeron, 'Bioinformatics Computing', Pearson Education.
3. Zhumur Ghosh, BibekanandMallick, 'Bioinformatics Principles and Applications', Oxford University Press 2008.

Reference Books

1. Orpita Bosu, Simminder Kaur Thukral 'Bioinformatics: Databases, Tools and Algorithms', Oxford press.
2. David W. Mount, 'Bioinformatics: Sequence and Genome Analysis.
3. Matej, Oresic, 'A Systems Biology to Study Metabolic Syndrome', Chapter 2, Systems Biology in Human Health and Disease, Springer International Publishing, Switzerland, 2014.
4. <http://www.ncbi.nlm.nih.gov/pubmed/21928407>.
5. <http://www.ias.ac.in/pubs/splpubs/pjubileebook/379.pdf>.
3. https://www.systemsbiology.org/sites/default/files/Hood_P4.pdf.

414464 B - ELECTIVE IV : REAL TIME AND EMBEDDED SYSTEMS**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:In-Semester Assessment
Phase I – 30 MarksEnd-Semester Assessment
Phase II – 70 Marks**Prerequisites :** Processor Architecture and Interfacing**Course Objectives :**

1. Understanding embedded system, processor & distributed embedded systems architecture.
2. Understanding Real Time system, Real time task scheduling & Real time operating system.

Course Outcomes :

1. Students should be able to design distributed embedded system for specific example.
2. Students should be able to schedule real time tasks as per the specific requirement.

UNIT - I EMBEDDED ARCHITECTURE**6 Hours**

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Categories of Embedded System, Embedded system design process-Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design-Structural Description, Behavioural Description, Design Example: Model Train Controller

UNIT – II EMBEDDED PROCESSOR AND COMPUTING PLATFORM**6 Hours**

ARM processor-processor and memory organization, Data operations, Flow of Control, SHARC processor-Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

UNIT - III NETWORKS**6 Hours**

Distributed Embedded Architecture-Hardware and Software Architectures, Networks for embedded systems-I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design-Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT - IV INTRODUCTION TO REAL-TIME SYSTEMS**6 Hours**

Characteristics of Real – Time Systems, Classification of Real – Time Systems, Types of Real-Time tasks – Timing constraints –Real-Time Scheduling: Basic concepts and classification of Algorithms – Clock-Driven Scheduling – Event-Driven Scheduling – Hybrid schedulers – EDF Scheduling – RM Scheduling and its Issues.

UNIT – V RESOURCE SHARING AND DEPENDENCIES AMONG REAL-TIME TASKS**6 Hours**

Resource sharing in Real Time tasks, Priority Inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Handling Task dependencies – Scheduling Real-Time Tasks in Multiprocessor and Distributed Systems – Resource Reclaiming in Multiprocessor RealTime Systems – Fault-Tolerant Task Scheduling in Multiprocessor Real-Time Systems.

UNIT - VI REAL-TIME OPERATING SYSTEM (RTOS)**6 Hours**

Features of RTOS, Commercial Real-Time Operating Systems, Real-Time Databases, Applications, Design issues, Characteristics of Temporal Data, Concurrency control, Commercial Real-Time

Databases.

Text Books

1. Frank Vahid, Tony Givargis Embedded system design: a unified hardware/ software introduction. Wiley publication.
2. C. Siva Ram Murthy and G. Manimaran, "Resource Management in Real-Time Systems and Networks", Prentice-Hall of India, 2005.

Reference Books

1. Raj Kamal, Embedded systems: Architecture, Programming and design; Tata McGraw Hill
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
3. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000.
4. Rajib Mall, "Real-Time Systems Theory and Practice", Pearson Education, India, 2007.
5. C.M. Krishna, Kang G. Shin, "Real-Time Systems", ISBN-13: 978-0-07-070115-1, MC GrawHill Education

414464 C - ELECTIVE IV : GREEN IT – PRINCIPLES AND PRACTICES**Teaching Scheme:**

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment

Phase I – 30 Marks

End-Semester Assessment

Phase II – 70 Marks

Prerequisites : The course assume no prior knowledge in this area**Course Objectives :**

1. To understand what Green IT is and How it can help improve environmental Sustainability
2. To understand the principles and practices of Green IT.
3. To understand how Green IT is adopted or deployed in enterprises.

Course Outcomes :

1. Students will be able to create awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement.
2. This green movement will create new career opportunities for IT professionals, auditors and others with special skills such as energy efficiency, ethical IT assets disposal, carbon footprint estimation, reporting and development of green products, applications and services.

UNIT – I INTRODUCTION**6 Hours**

Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and Eco-Labeling, Enterprise Green IT Strategy, Green IT: Burden or Opportunity?

Hardware: Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose.**Software:** Introduction, Energy-Saving Software Techniques, Evaluating and Measuring Software Impact to Platform Power.**UNIT - II SOFTWARE DEVELOPMENT AND DATA CENTERS****6 Hours**

Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics.

UNIT - III DATA STORAGE AND COMMUNICATION**6 Hours**

Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management, Objectives of Green Network Protocols, Green Network Protocols and Standards.

UNIT - IV INFORMATION SYSTEMS, GREEN IT STRATEGY AND METRICS**6 Hours**

Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information, Measuring the Maturity of Sustainable ICT.

UNIT - V GREEN IT SERVICES AND ROLES**6 Hours**

Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework, Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware, Inter-organizational Enterprise Activities and Green Issues, Enablers and Making the Case for IT and the Green Enterprise.

UNIT – VI MANAGING AND REGULATING GREEN IT

6 Hours

Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social Media, The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Green Data Centres, Social Movements and Greenpeace.

Text Book

1. San Murugesan, G. R. Gangadharan: Harnessing Green IT, WILEY 1st Edition-2013

414464 D - ELECTIVE IV : INTERNET OF THINGS

Teaching Scheme:

Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks

Prerequisites : Fundamentals of Computer Network, Computer Network

Course Objectives :

1. To understand what Internet of Things is.
2. To get basic knowledge of RFID Technology, Sensor Technology and Satellite Technology.
3. To make students aware of resource management and security issues in Internet of Things.

Course Outcomes :

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

1. Explain what Internet of Things is.
2. Describe key technologies in Internet of Things.
3. Understand wireless sensor network architecture and its framework along with WSN applications.
4. Explain resource management in the Internet of Things.
5. Understand business models for the Internet of Things.

UNIT - I INTRODUCTION

6 Hours

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

UNIT - II FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES

6 Hours

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology,

UNIT - III RADIO FREQUENCY IDENTIFICATION TECHNOLOGY

6 Hours

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues

EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication

WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

UNIT - IV RESOURCE MANAGEMENT IN THE INTERNET OF THINGS

6 Hours

Clustering, Software Agents, Clustering Principles in an Internet of Things Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

UNIT - V INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE**6 Hours**

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT.

UNIT - VI BUSINESS MODELS FOR THE INTERNET OF THINGS**6 Hours**

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Internet of Things Application : Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards,

Text Books

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Wiley Publications
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Parikshit N. Mahalle & Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).

Reference Books

1. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Wiley Publications
3. Daniel Kellmerit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700.
4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach", Elsevier, ISBN: 978-81-8147-642-5.

414464 E - ELECTIVE IV : OPEN ELECTIVE

In this subject, a student can opt for a subject from other branch of engineering (preferably *Computer Engineering* and *Electronics & Telecommunication*). An institution may design the syllabus of a subject in consultation with a software company/industry. This syllabus will be approved by the University authorities and then students can opt for the same as an open elective.

414465 : SOFTWARE LABORATORY – V**Teaching Scheme:**

Practical : 2 Hours/Week

Examination Scheme:

Term Work : 25 Marks

Practical : 25 Marks

Prerequisites: Operating System, Computer Networks and Web Engineering and Technology.**Course Objectives :**

1. To understand the fundamentals of distributed environment in complex application.
2. To get comprehensive knowledge of the architecture of distributed systems.
3. To make students aware about security issues and protection mechanism for distributed environment.

Course Outcomes :

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

1. Understand the principles on which the internet and other distributed systems are based.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.

Contents

1. Design a distributed application using RMI for remote computation where client submits two strings to the server and server returns the concatenation of the given strings.
2. Design a distributed application using RPC for remote computation where client submits an integer value to the server and server calculates factorial and returns the result to the client program.
3. Design a distributed application using Message Passing Interface (MPI) for remote computation where client submits a string to the server and server returns the reverse of it to the client.
4. Design a distributed application which consist of a server and client using threads.
5. Design a distributed application which consists of an agent program that program travels in the network and performs a given task on the targeted machine. You may assign any task to the agent e.g. to carry out the existing file opening and reading number of vowels present in that file.
6. Design a distributed application using MapReduce which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform.
7. Design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.
8. Design and develop a distributed Hotel booking application using Java RMI.

A distributed hotel booking system consists of the hotel server and the client machines. The server manages hotel rooms booking information. A customer can invoke the following operations at his machine

- i) Book the room for the specific guest
 - ii) Cancel the booking of a guest
1. Enquire the check in date for the specified customer/guest.

Term work:

Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Reference Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, & Gordon Blair, "Distributed Systems – Concept and Design", 5th Edition, Publisher: Pearson, ISBN – 978-13-214301-1.
2. Randay Chow, Theodore Johnson, "Distributed Operating System and Algorithm Analysis", Publisher: Pearson (LPE). ISBN – 978-81-317-2859-8.

414466 : SOFTWARE LABORATORY – VI**Teaching Scheme:**

Practical : 4 Hours/Week

Examination Scheme:

Practical : 50 Marks

Oral : 50 Marks

Prerequisites : Database Management System**Course Objectives :**

1. To learn and understand Database Modeling, Architectures.
2. To learn and understand Advanced Database Programming Frameworks.
3. To learn and understand web database language, XML, JDOQL.
4. To learn NoSQL Databases (Open source) such as Hive/ Hbase/ Cassandra/DynamoDB.

Course Outcomes :

1. Understanding of Advanced Database Programming Languages.
2. Master the basics of web and object oriented database languages and construct queries using XML and JDOQL.
3. Master the basic concepts of NoSQL Databases.
4. Understand how analytics and big data affect various functions now and in the future.
5. Appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.

Contents

1. Study and Configure Hadoop for Big Data
2. Study of NoSQL Databases such as Hive/Hbase/Cassandra/DynamoDB
3. Design Data Model using NoSQL Databases such as Hive/Hbase/Cassandra/DynamoDB
4. Implement any one Partitioning technique in Parallel Databases
5. Implement Two Phase commit protocol in Distributed Databases
6. Design Persistent Objects using JDO and implement min 10 queries on objects using JDOQL in ObjectDB NOSQL DATABASE
7. Create XML, XML schemas , DTD for any database application and implement min 10 queries using XQuery FLOWR expression and XPath
8. Design database schemas and implement min 10 queries using Hive/ Hbase/ Cassandra column based databases
9. Design database schemas and implement min 10 queries using DynamoDBkeyValue based databases
10. Implement Web Page ranking algorithm
11. Implement any one machine learning algorithm for classification / clustering task in BIG data Analytics
12. Design and Implement social web mining application using NoSQL databases, machine learning algorithm, Hadoop and Java/.Net

Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Instructor should frame Practical Assignments based on above mentioned list of assignments. Submission of each Practical Assignment should be in the form of handwritten write-ups/ printout of

source code and output. Instructor should assign an assignment no. 12 to a group of 3 - 4 students Practical Examination will be based on the all topics covered and questions will be asked to judge understanding of practical performed at the time of practical examination

Group of students should submit the Report for assignment no. 12 which will be consist of Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling , Database design, Algorithms, Graphical User Interface, Source Code, Testing document, Conclusion.

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Reference Books

1. <http://nosql-database.org/>
2. Hadoop, O'Reilly Publications.
3. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X.
4. <http://www.objectdb.com/database/jdo>
5. Data Mining: Concepts and Techniques by Jiawei Han, MichelineKamber, Jian Pei, Elsevier.

414467 : PROJECT WORK**Teaching Scheme:**

Tutorial : 6 Hours/Week

Examination Scheme:

Term work : 50 Marks

Oral : 100 Marks

Prerequisites :BE-Project Phase I – Semester I, Project Based Seminar**Course Objectives :**

1. To expose students to product development cycle using industrial experience, use of state of art technologies.
2. To encourage and expose students for participation in National/International paper presentation activities and funding agency for sponsored projects.
3. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.

Contents**Reviews3: Based on Implementation (50% implementation expected)****Reviews4: Complete Project and Testing****Project Exhibition:** All TE students must see all the projects in the exhibition

The group will submit at the end of semester II.

- a) The Workable project.
- b) Project report (in Latex/Lyx/latest Word) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for certification.

The project report contains the details.

1. Problem definition
2. Requirement specification
3. System design details (UML diagrams)
4. System implementation – code documentation – dataflow diagrams/ algorithm, protocols used.
5. Test result and procedure – test report as per ATP.
6. Conclusions.
7. Appendix
 - a. Tools used
 - b. References
 - c. Papers published/certificates

Plagiarism Report of paper and project report from any open source tool

One paper should be published in reputed International conference/International journal

Unified communications and contact center Applications

Teaching Scheme

Lectures/Week:4

Practical's /Week: None

Examination Scheme

Paper: 100 Marks

Oral: None

Unit 1: Introduction to digital and IP Telephony

6 Hours

Digital Telephony: circuit switched networks, ss7, ISDN, Exchanges, E.164 Numbering Plans
IP Telephony: Packet switched Networks, signaling & Media separation' Media Encapsulation '
RTP and RTCP, Audio and Video Codecs

Unit 2: VoIP Protocols

10 Hours

H.323 Network Elements: Terminals, Gateway, Gate keeper, Multi point Control Unit
H.323 protocol: RAS Channel, H.225 Call signaling, H.245 Media signaling
H.323 Call flows: Basic Audio and Video Call flows
SIP Network Elements: Registrar, Proxy, UAS, UAC, B2BUA
SIP Protocol: Requests and Responses, Methods, Headers and Parameters, Message structure,
Transactions and Dialogs, Session Description Protocol
SIP Call Flows: Basic Audio and Video Call Flows
H.248 protocol : Media Gateways, Media Gateway controllers, commands, Transactions,
Contexts, Terminations, Descriptors' Packages

Unit 3: Unified Communications

6 Hours

Local and Network features: Call Forward, Call coverage, Automatic Call Back, User Displays,
Resource Optimization.
Voice & Data Integration: IM, presence, voice mail,
collaboration: call Conferencing, Voice, Video, Data and content integration.
Mobility: Mobile Clients, Session Border Controllers.
Business Applications: Framework for custom applications, computer Telephony Interface,
Application Sequencing.

Unit 4: Inbound Contact Center

8 Hours

Call Centers: Introduction, Evolution and classification of Contact Centers.
Inbound Contact Center :Introduction Self Service / Interactive Voice Response, Routing,
Intelligent Routing, VXML
Agent : Skills, Selection Algorithms, Modes, Service Observing, Recording

Unit 5: Outbound Contact Center and Reporting

8 Hours

outbound contact center: Introduction, Proactive contact: voice, SMS, E-mail & chat. Contact
Center Reporting: Types of Reports, Business use cases.
Analytics: Agent Performance, Occupancy

Unit 6: Emerging technologies in Telecommunications

6 Hours

High Availability: Load balancing, Reliability, Failover & Failback, Location Redundancy, Hardware footprint, cloud Computing : Applications in Telecommunications Analytics in Voice & Data, Diagnostics & Management
Emerging Technologies: Google Glass, webRTC, Hosting on Cloud.

Text Books

1. Allan Sulkin, "PBX Systems for IP Telephony" McGraw-Hill Professional

Reference books

1. ITU-T H.323 Packet-based multimedia communications systems
2. ITU-T H.225 Call Signaling Protocols and media stream packetization
3. ITU-T H.245 Control protocol for multimedia communication
4. IETF RFC 3261 SIP: Session Initiation Protocol
5. IETF RFC 4566 SDP: Session Description Protocol
6. Contact Center for 'Dummies, Wiley Publishing Inc.
7. Real Time Communication with WebRTC, O'Reilly Publishing