Syllabus
Savitribai Phule Pune University
Faculty of Engineering
B.E. Computer Engineering
(Course 2012)
(w.e.f June 2015)

Board of Studies Computer Engineering

June 12, 2015

Preamble

It is my pleasure to present this B.E. Computer Engineering Syllabus. The syllabus is a blend of concepts and advances using high end FOSS technologies. One of the objectives of the this syllabus is to cultivate students for using FOSS and contributions in FOSS. The theory subjects are based on the pre-requisites covered in first year to third Year computer engineering. 16 electives are divided into four groups on recent technologies such as cloud computing, mobile computing, web applications and Business Analytic and Intelligence, Cyber Security are provided which shall be useful for student in their professional carrier.
The laboratories for problem solving practices are based on utilization of state-of-the art FOSS software Technologies used by the Industries. The FOSS technologies are available with source code students can experiment the performance improvement and ideation to replace the existing implementation. The Project can be done as conventional practices or as an entrepreneur project to give thrust on generating budding talent as entrepreneur to lead the industrial front of the nation worldwide.

For BoS Computer Engineering
Prof. Sarang Joshi

Program Educational Objectives

- To create competencies and opportunities for Higher Education;
- To create professional manpower skilled for the IT Industry;
- To provide laboratory practices with advanced FOSS Tools;
- To provide inter-disciplinary opportunities;
- To provide opportunities of developing technical documents and presentation skills.
- to provide opportunities of industry-Institute interactions;
- To develop opportunities to promote Entrepreneurship and start-ups;
- To nurture professional and social ethics.

Program Objectives

- To expose students to the Systems and Applications Programming, Organizations and Architectures;
- To provide conceptual knowledge in the Computing domain;
- To provide interdisciplinary knowledge;
- To expose students with advanced tools used in industry;
- To develop written and soft-skill competencies;
- To develop team work experience of professionals skills for IT Industry.

Program Outcomes

- To test applications with concepts and skills in the domain subjects;
- To demonstrate skills in programming techniques and technologies;
- To demonstrate oral and written skills for technical presentations and documentation;
- To demonstrate IT project as team work;
- To demonstrate social and Professional ethical practices;

SAVITRIBAI PHULE PUNE UNIVERSITY

BE (COMPUTER ENGINEERING)- 2012 COURSE STRUCTURE

Term-I

Subject Code	Subject	Teaching Scheme			Examination Scheme				Total Marks
		Lect	Tut	Pract	In Sem Asmnt	PR/ TW	OR/ TW	End Sem Asmnt	
410441	Design & Analysis of Algorithms	03	—	—	30	—	—	70	100
410442	Principles of Modern Compiler Design	04	—	—	30	—	—	70	100
410443	Smart System Design and Applications	03	—	—	30	—	—	70	100
410444	Elective-I	03	—	—	30	—	—	70	100
410445	Elective-II	03	—	—	30	—	—	70	100
410446	Computer laboratory-I	—	—	04	—	50	50	—	100
410447	Computer Laboratory-II	—	—	04	—	50	50	—	100
410448	Project	—	02	—	—	50	—	—	50
	Total	16	02	08	150	150	100	350	750
	Term-II								
410449	Software Design Methodologies & Testing	03	—	—	30	—	—	70	100
410450	High Performance Computing	03	—	—	30	—	—	70	100
410451	Elective-III	03	—	—	30	—	—	70	100
410452	Elective-IV Open Elective	03	—	—	30	—	—	70	100
410453	Computer laboratory-III	—	—	04	—	50	50	—	100
410454	Computer Laboratory-IV	—	—	04	—	50	50	—	100
410455	Project	—	06	—	—	50	100	—	150
	Total	12	06	08	120	150	200	280	750

Electives:

Semester-I		Semester-II	
	ELECTIVE-I		**ELECTIVE-III**
1.	Image Processing	1.	Mobile Computing
2.	Computer Network Design and Modeling	2.	Web Technology
3.	Advanced Computer Programming	3.	Cloud Computing
4.	Data Mining Techniques and Applications	4.	Cyber Security
	ELECTIVE-II		**ELECTIVE-IV (Open Elective)**
1.	Problem Solving with Gamification	1.	Business Analytic and Intelligence
2.	Pervasive Computing	2.	Operations Research for Algorithms in Scientific Applications
3.	Embedded Security	3.	Mobile Applications
4.	Multidisciplinary NLP	4.	Open Elective

Open Elective: The listed open electives or any other Elective that is being taught in the current semester (semester-II) under the faculty of engineering or individual college and Industry can define new elective with complete (6 units) syllabus using defined framework of Elective IV and GET IT APPROVED FROM THE BOARD OF STUDIES (COMPUTER ENGINEERING) AND OTHER NECESSARY STATUTORY SYSTEMS IN THE SAVITRIBAI PHULE PUNE UNIVERSITY BEFORE 30th DECEMBER.

410441 Design and Analysis of Algorithms

Teaching Scheme
Lectures: 3 Hrs/ Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using mathematical theories;
- To apply algorithmic strategies while solving problems;
- To develop time and space efficient algorithms;
- To study algorithmic examples in distributed, concurrent and parallel environments.

Course Outcomes:

- To solve problem in the UG projects;
- To develop SRS in the UG projects;
- To solve problems for multi-core or distributed or concurrent/Parallel/Embedded environments;

Unit	Content	Hrs
I	**Problem solving and Algorithmic Analysis** Problem solving principles: Classification of problem, problem solving strategies, classification of time complexities (linear, logarithmic etc) problem subdivision – Divide and Conquer strategy. Asymptotic notations, lower bound and upper bound: Best case, worst case, average case analysis, amortized analysis. Performance analysis of basic programming constructs. Recurrences: Formulation and solving recurrence equations using Master Theorem.	6
II	**Greedy and Dynamic Programming Algorithmic Strategies**	6
	Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problem. **Dynamic Programming:** Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix multiplication.	
III	**Backtracking and Branch-n-Bound**	8
	Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem. **Branch-n-Bound:** Principle, control abstraction, time analysis of control abstraction, strategies – FIFO, LIFO and LC approaches, TSP, knapsack problem.	
IV	**Complexity Theory**	6
	Overview: Turing machine, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P class, NP class & NP complete problems- vertex cover and 3-SAT and NP–hard problem – Hamiltonian cycle. The menagerie of complexity classes of Turing degrees. Concept of randomized and approximation algorithms: Solving TSP by approximation algorithm, Randomized sort algorithms and Approximating Max Clique.	
V	**Parallel and Concurrent Algorithms**	6
	Parallel Algorithms: Sequential and parallel computing, RAM & PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis and optimal parallel algorithms, graph problems (shortest paths and Minimum Spanning Tree, Bipartite graphs) **Concurrent Algorithms:** Dining philosophers problem	

VI	**Algorithmic Case-studies**	8
	Distributed Algorithms: Bully algorithm – method for dynamically selecting a coordinator, all pair shortest path (Floyed-Warshall Algorithm), Dijkstra-Scholten algorithm – detection of process termination, Buddy memory algorithm – method to allocate memory. **Embedded Algorithms:** Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems. **Internet of Things and Data Science Algorithms:** Algorithms in IoT: Cryptography Algorithms, Scheduling Algorithms, Data management Algorithms and clustering, context management. Data Science Project Life Cycle(DSPLC), Mathematical Considerations: Mathematical modeling, Optimization Methods, Adaptive and Dynamic Algorithms and Numerical Analysis in IoT **Algorithms in Software Engineering:** String matching algorithm-Boyer-Moore algorithm KMP algorithm.	

Text Books:

Sl. No.	Text Books
1.	Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2ND Edition. University Press, ISBN: 978 81 7371 6126, 81 7371 61262.
2.	Gilles Brassard and Paul Bartley, "Fundamental of Algorithmics", PHI, New Delhi.
3.	Algorithms, Kenneth Berman and Jerome Paul, Cenage Learning, ISBN-13 978-81-315-0521-2

Reference Books:

Sl. No.	Reference Books
1.	Algorithms and Parallel Computing, Fayez Gebali, Willy, ISBN 978-0-470-90210-3 (Indian Paperback Edition)
2.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education
3.	Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" PHI
4.	BoS Content Development: Prof. Sarang Joshi, Dr. Parikshit Mahalle, "Design and Analysis of Algorithms: A Problem Solving Approach", Cambridge University Press, 2015

410442 Principles of Modern Compiler Design

Teaching Scheme
Lectures: 4 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Prerequisite:

- Fundamentals of Data structures
- Theory of Computation
- Concepts of Operating Systems
- Study of Programming Languages

Course Objectives:

- To study concepts in assembling, parsing and compiling into target code for execution.
- To Understand systems and methods of compilation.
- To introduce basic tools for compiler writing and expose the latest techniques and advances in compiler.
- To get exposed to concurrent, embedded and distributed compilation tools and techniques.

Course Outcomes:

- To solve problem of parsing and compiling.
- Ability to design and write simple compiler.
- To be able to use compiler tools in basic, concurrent, distributed and embedded environments.
- To develop awareness of latest trends and advances in compilers

Unit	Content	Hrs
I	**Notion and Concepts**	6
	Introduction to compilers – Design issues, passes, phases, symbol table Preliminaries – Memory management, Operating system support for compiler, Compiler support for garbage collection Lexical Analysis – Tokens, Regular Expressions, Process of Lexical analysis, Block Schematic, Automatic construction of lexical analyzer using LEX, LEX features and specification	
II	**Parsing**	8
	Syntax Analysis – CFG, top-down and bottom-up parsers, RDP, Predictive parser, SLR, LR(1), LALR parsers, using ambiguous grammar, Error detection and recovery, automatic construction of parsers using YACC, Introduction to Semantic analysis – Need of semantic analysis, type checking and type conversion	
III	**Syntax Translation Schemes**	7
	Syntax Directed Translation and Intermediate Code Generation – Attribute grammar, S and L attributed grammar, bottom up and top down evaluations of S and L attributed grammar, Intermediate code – need, types, Syntax directed translation scheme, Intermediate code generation for - assignment statement, declaration statement, Boolean expression, if-else statement, do -while statement, array assignment.	
IV	**Code Generation and Optimization**	8
	Code Generation and Code Optimization – Issues in code generation, basic blocks, flow graphs, DAG representation of basic blocks, Target machine description, Register allocation and Assignment, Simple code generator, Code generation from labeled tree, Concept of code generator. Need for Optimization, local, global and loop optimization, Optimizing transformations – compile time evaluation, common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination, DAG based local optimization, peephole optimization, Introduction to global data flow analysis, Data flow equations and iterative data flow analysis (only introduction expected)	

V	**Functional and Logic Programs**	7
	Language Specific Compilation: Object Oriented languages – source language issues, routines and activation, code generation and control flow Functional languages - introduction to Functional Programs, basic compilation, polymorphic type checking, desugaring , compiling to a register-oriented architectures JavaCC (Chapter 13 of reference book 1)	
VI	**Parallel and Distributed Compilers**	8
	Parallel programming models, Processes and threads, Shared variables Message passing, Parallel Object Oriented languages, Tuple space, Automatic parallelization Introduction to advanced topics – JIT, Dynamic compilation, Interpreters (JVM/Dalvik), Cross compilation using XMLVM, Case studies(self study): GCC, g++, nmake,cmake. NVCC (case study for parallel compilation), LLVM	

Text Books:

Sl.No.	Text Books
1.	A V Aho, R Sethi, J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8
2.	Dick Grune, Bal, Jacobs, Langendoen, Modern Compiler Design, Wiley, ISBN 81-265-0418-8

Reference Books:

Sl.No.	Reference Books
1.	Compiler Construction Using Java, JavaCC and Yacc, Anthony J. Dos Reis, Wiley ISBN 978-0-470-94959-7
2.	K Muneeswaran, "Compiler Design", Oxford University press, ISBN 0-19-806664-3
3.	J R Levin, T Mason, D Brown, "Lex and Yacc", O'Reilly, 2000 ISBN 81-7366-061-X

410443 Smart System Design and Applications

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To study multidisciplinary requirements of problem solving;
- To study concepts of Artificial Intelligence;
- To study smart systems programming and application development;
- To study examples in distributed, concurrent and parallel environments.

Course Outcomes:

- The study of one solve multidisciplinary case-study;
- To use embedded systems using machine learning;
- To solve problems for multi-core or distributed, concurrent and embedded environments;

Unit	Content	Hrs
I	**Introduction to Intelligent Systems**	4
	Introduction, History, Foundations and Mathematical treatments, Problem solving with AI, AI models, Learning aspects in AI, What is an intelligent Agents, Rational agent, Environments types, types of Agents	
II	**Problem-solving and Building Smart Systems**	6
	Problem solving process, Problem analysis and representation, Problem space and search, Toy problems, real world problems, Problem reduction methods, General Search algorithms, Uninformed Search methods, Informed (Heuristic) Search – Best first, Greedy, A* search methods, Heuristic Functions, AO*, Local Search Algorithms and optimization problems, Adversarial search methods, Important concepts of Game theory, Game theory and knowledge structure, Game as a search problem, Alpha-Beta Pruning, Stochastic Games, Constraint Satisfaction Problem, CSP as search problem	
III	**Knowledge, Reasoning, and Planning**	7
	Knowledge based agents, The Wumpus World, Logic, propositional logic, Representation of knowledge using rules, Predicate logic, Unification and lifting, inference in FOL, Forward Chaining, Backward Chaining, Resolution, Logic Programming. Planning problem, Planning, Algorithms for Planning as State-Space Search, Planning Graphs, simple planning agent, planning languages, blocks world problem, goal stack planning, mean end analysis, progression planners, regression planners, partial order planning, planning graphs, hierarchical planning, job shop scheduling problem, Planning and Acting in the Real World, Hierarchical Planning, Multi-agent Planning, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World	
IV	**Uncertain Knowledge and Decision Theory**	6
	Uncertainty and methods, Basic Probability Notion, Inference Using Full Joint Distributions, Bayesian probability and belief networks, Relational and First-Order Probability Models, Other techniques in uncertainty and reasoning, Inference in Temporal Models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian Networks, Decision network, Semi-constraint influence diagram, Decision making and imperfect information, Combining Beliefs and Desires under Uncertainty, The Basis of Utility Theory, Utility Functions, Multi-attribute Utility Functions, Decision Networks, Decision-Theoretic Expert Systems	

V	**Learning Tools, Techniques and Applications**	7
	Machine Learning Concepts, methods and models, Supervised Learning, unsupervised and semi-supervised, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Artificial Neural Networks, Non-parametric Models, Support Vector Machines, Ensemble Learning, empirical learning tasks, Explanation-Based Learning, Inductive Logic Programming, Reinforcement Learning, Active Learning, Learning based on limited information. Building Smart systems using different learning techniques, smart system applications, agent based concurrent engineering	
VI	**Communicating, Perceiving, and Acting**	6
	Language Models, Text Classification, Information Retrieval, Information Extraction, Phrase Structure Grammars, Syntactic Analysis (Parsing), Augmented Grammars and Semantic Interpretation, Machine Translation, Speech Recognition, Image Formation and object recognition, Early Image-Processing Operations, Object Recognition by Appearance, Reconstructing the 3D World, Object Recognition from Structural Information, Using Vision, Robot Hardware, Robotic Perception, Planning to Move, Planning Uncertain Movements, Robotic Software Architectures, Application Domains	

Text Books:

Sl.No.	Text Books
1.	Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
2.	Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2003.

Reference Books:

Sl.No.	Reference Books
1.	Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH
2.	Shai shalev-shwartz, Shai Ben-David: Understanding Machine Learning from Theory to algorithms, Cambridge University Press, ISBN-978-1-107-51282-5, 2014.

410444A Elective-I: Image Processing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To study image processing concepts;
- To study mathematics and algorithms for image processing;
- To study applications in image processing;
- To study algorithmic examples in distributed, concurrent and parallel environments.

Course Outcomes:

- To perform image processing programming;
- To solve Image Processing problems using multi-core or distributed, concurrent/Parallel environments.

Unit	Content	Hrs
I	**Introduction to Image processing**	6
	Introduction, Image sampling and quantization, Resolution, Human visual system, Classification of digital images, Image types(optical and microwave), Elements of an image processing system, Image file formats(tiff, jpeg, ico, ceos, png, raster image format), Introduction to OpenCV tool to Open and display Images using Python or Eclipse C/CPP.	
II	**Image Enhancement** Thresholding, Segmentation, Watershed Segmentation, Edge-based Segmentation, Fuzzy Segmentation Spatial domain techniques – Image Negative, Contrast stretching, gray level slicing, bit plane slicing, histogram and histogram equalization, local enhancement technique, image subtraction and image average, low–pass spatial filters, median filtering, high-pass spatial filter, derivative filters,Frequency domain techniques- Ideal low-pass filter, butterworth low-pass filter, High-pass filter, Homo-morphic filters.	6
III	**Image Analysis**	8
	Image segmentation- Classification of image segmentation techniques: Watershed Segmentation, Edge-based Segmentation, Fuzzy Segmentation, region approach, clustering techniques, thresholding , edge-based, classification of edges and edge detection, watershed transformation Feature Extraction- Boundary representation(Chain code, B-spline representation, fourier descriptor) Region representation(Area, Euler number, Eccentricity, Shape matrix, moment based descriptor), texture based features	
IV	**Image Compression and Object recognition**	8
	Introduction to Image compression and its need, Coding redundancy, classification of compression techniques(Lossy and lossless- JPEG, RLE, Huffman, Shannon fano), scalar and vector quantization Object Recognition – Need, Automated object recognition system, pattern and pattern class, relationship between image processing and object recognition, approaches to object recognition	
V	**Medical Imaging**	6
	Medical Image obtained with ionizing radiation- medical imaging modalites, images from X –rays,Gamma rays, Dose and Risk, Medical Image obtained with non-ionizing radiation: Ultrasound imaging, magnetic resonance imaging, PACS, 3D visualization: Image visualization, Surface and volume rendering, Virtual reality, Dental & Digital X-Ray Processing, RBC Image Processing, 3-D Visualization	

VI	**Remote sensing Imaging**	6
	Definition of Remote sensing, Remote sensing process, Photogrammetry, Electromagnetic spectrum, Interaction with atmosphere,Recording of energy by sensor, Transmission, Reception and Processing, Atmospheric sensors, Active remote sensors, Passive microwave remote sensing, Satellite Images,Visual Image Interpretation: Introduction, Remote sensing data products, Image interpretation, Elements of visual image interpretation, Interpretation keys, Thermal and Radar image interpretation, Pre-processing,Application of Remote Processing.	

Text Books:

Sl.No.	Text Books
1.	Fundamentals of Digital Image Processing, Anil K. Jain, PHI, ISBN 81-203-0929-4
2.	Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press, ISBN: 978-0-521-18193-8.
3.	Digital Image processing by S.Jayaraman, McGraw Hills Publication
4.	Fundamentals of Digital Image Processing by S. Annadurai, Pearson publication
5.	Fundamentals of Digital Image Processing by A.K. Jain, PHI Publication
6.	Digital Image Processing for Medical Applications by Geoff Dougherty, Cambridge university press
7.	Remote sensing and GIS by Basudeb Bhatia, 2nd edition, OXFORD University press. Chapter [1,5,9,12]

Reference Books:

Sl.No.	Reference Books
1.	Handbook of Medical Imaging, Processing and Analysis, Academic Press, ISBN 0-12-077790-8 (PDF Book)
2.	Essential Image Processing and GIS for Remote Sensing, Jian Guo Liu Phillippa Mason, ISBN 978-0-470-51032-2

410444B Elective-I: Computer Network Design and Modeling

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To expose students to the area of network design, modeling and analysis.
- To expose students to the complete life cycle of the network design.
- To motivate students to think performance perspective towards design & analysis of the computer network.
- To expose students to the various open source network design tools.
- To study algorithmic examples in distributed, concurrent and parallel environments.

Course Outcomes:

- Students will be able to design, model and analyze computer network.
- Students will be able to use tools for network design, modeling and analysis.
- To solve problems for multi-core or distributed, concurrent/Parallel environments.

Unit	Content	Hrs
I	**Introduction, requirement analysis: concepts**	8
	Overview of network analysis and design process, System description and methodology, Service description and characteristics, performance characteristics, requirement analysis (user, application, device, network, other) concepts, requirement specification and map.	
II	**Requirement Analysis: process**	6
	Requirement gathering and analysis (developing service metrics, characterizing behavior, Developing RMA, delay, capacity, performance requirements, Environment-Specific Thresholds and Limit, Requirements Mapping)	
III	**Flow analysis and Network architecture**	6
	Identifying and Developing Flows, Data Sources and Sinks, Flow Models, Flow Prioritization & specification, examples of flow analysis, Component Architectures, Reference Architecture, Architectural Models, Systems and Network Architectures.	
IV	**Addressing, routing and Network management architecture**	8
	Addressing Mechanisms, Routing Mechanisms, Addressing Strategies, Routing Strategies,Architectural Considerations of addressing, Network Management Mechanisms, Architectural Considerations of network management.	
V	**Network Performance and Design**	6
	Developing Goals for Performance, Performance Mechanisms, Architectural Considerations, Design Process, Vendor, Equipment, and Service-Provider Evaluations, Network Layout, Design Traceability, Design Metrics.	
VI	**Tools for Network Design, Modeling and Analysis**	6
	Discrete event simulation, modeling for computer simulation, NS-3 or latest version or equivalent, modeling network elements, Simulating a Computer Network, Smart Pointers, Representing Packets, Object Aggregation, Events in NS–3 or latest version or equivalent, Compiling and Running the Simulation, Animating the Simulation, Scalability with Distributed Simulation, Emulation Capabilities, Analyzing the Results, Overview of OMNet.	

Text Books:

Sl.No.	Text Books
1.	James D. McCabe, "Network Analysis, Architecture, and Design", Morgan Kaufmann Publisher (ELSEVIER), 3rd edition
2.	Wehrle, Klaus, Günes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", Springer, ISBN: 978-3-642-12330-6

Reference Books:

Sl.No.	Reference Books
1.	Priscilla Oppenheimer, "Top Down Network Design", 3rd Edition, Cisco Press

410444C Elective-I: Advanced Computer Programming

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To study advanced computer programming technologies
- To apply advanced programming to data technologies
- Study the concept of Object Distribution and invoking its services remotely in Distributed environment
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem using advanced programming
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Distributed Programming**	8
	Introduction, Simple Lock, Bounded Buffer, Message-Passing Services,Distributed Lock Service:- Distributed Lock using Timestamps,Object-Transfer Service: Object Transfer using Path Reversal,Distributed Shared Memory Service:- A Single-Copy Distributed Shared Memory, A Multi-Copy Distributed Shared Memory.	
II	**Java Programming Concepts**	6
	Relflections, Boxing and Unboxing, Object serialization and Deserialization, Important Java Utility classes (StringTokenizer, Observable), Java Collection framework (LinkedList, ArrayList,Sets, Hashsets, Treeset, Hashmap,Treemap, Vectors, Stack, Dictionary,Hashtable, Itrators)	
III	**SOA and Programming**	8
	What is Service? Role/Use of service in Cloud based environment, Service Orchestration and Distribution. Introduction to RMI (Remote Method Invocation), SOAP, Servlet, WSDL,Developing Web services using Java. Introduction to Enterprise Java Beans(EJBs): Concept of Entity Beans, Message Beans and Session Beans with one example each of word count program.	
IV	**Web Programming**	6
	HTML and Java Script Programming: Embedding JS in HTML, Handling Events, Variables in JS, Creating Objects uing JS, Operators, Control flow statements, Functions, JDBC, JSP, Web Architecture models, MVC Architecture Models, advantages of JSP over Servlets, Tag based approach, JSP architecture, JSP life Cycle, Creating simple JSP Page, JSTL, JDBC features, JDBC APTs,JDBC Classes and Interfaces,Implementing JDBC Processes with MongoDB, system.js collection for MongoDB, AJAX: Creating sample AJAX Application, Document Object Model, JS and AJAX, Implementing AJAX frameworks.	
V	**Hadoop Programming**	6
	Data Science, in-memory analytics, in-database processing, symmetric multi-processing systems(SMP), Massively parallel Processing, difference between parallel and Distributed Systems,Shared memory, shared disk, Shared Nothing Architecture(SNA), advantages of SNA, CAP Theorem, NoSQL, NewSQL, Features and Advantages of Hadoop, Hadoop Ecosystem, RDBMS verses Hadoop, Hadoop Distributions: Hadoop, HDFS, HDFS Daemons,File read, File write, Hadoop YARN, Word-Count Program	

VI	**Advanced Tools, Techniques and Applications**	6
	Processing data with Hadoop, MapReduce Daemons, Concept of Mapper, Reducer, Combiner, Partitioner, Searching and Sorting using MapReduce, Map-Reduce working and example: Word count MapReduce programming using Java, MongoDB and MapReduce function, Pig: features, anatomy, Pig on Hadoop, ETL Processing, Data types and Complex data types in Pig, Running Pig: Interaction, Batch Modes, Execution modes of Pig: Local and MapReduce Modes, HDFS Commands, Relational Operators, EVAL function, UDF, Parameter Substitution, Diagnostic Operators, Word Count example using Pig.	

Text Books:

Sl.No.	Text Books
1.	Distributed Programming, Theory and Practice by Shankar and A. Udaya
2.	Seema Acharya, S. Chellapan, BIG DATA and Analytics, Wiley, 2015, ISBN:978-81-245-5478-2
3.	Web Technologies: HTML, JS, PHP, Java, JSP, ASP.NET, XML, AJAX, Black Book, DreamTech, ISBN: 978-81-7722-997-4

Reference Books:

Sl.No.	Reference Books
1.	Java Complete Reference by Herbert Schidlt
2.	Hadoop : The Definitive Guide.

410444D Elective-I: Data Mining Techniques and Applications

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Requisites: TE Database Management System and Applications, Data warehouse, OLTP

Course Objectives:

- To understand Data Mining Concepts.
- To understand Data Mining needs and Application.
- To study concepts of pattern based data mining for decision making.
- To study algorithmic examples in distributed, concurrent and parallel environments.

Course Outcomes:

- To develop programs and methods for data Mining applications.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Introduction, Knowledge of Data, Data Processing**	6
	Data mining described, need, kinds of pattern and technologies, issues in mining, KDD vs data mining, machine learning concepts, OLAP, knowledge representation, data pre-processing – cleaning, integration, reduction, transformation and discretization, application with mining aspect example like weather prediction.	
II	**Concepts of frequent patterns, Associations and Correlation**	4
	Market Basket Analysis, Frequent item set, Closed item set & Association Rules, mining multilevel association rules, constraint based association rule mining, Apriori Algorithm, FP Growth Algorithm.	
III	**Classification**	8
	Introduction, classification requirements, methods of supervised learning, decision trees- attribute selection, tree pruning, ID3, scalable decision tree techniques, rule extraction from decision tree, Regression, Bayes classification – Bayes theorem, Naïve Bayes classification, metrics for performance evaluation, KNN approach with Case study.	
IV	**Clustering**	5
	Cluster analysis, distance measures, partitioning methods – k-means, k-medoids, hierarchical methods – single-link, complete-link, centroid, average link, agglomerative method.	
V	**Text and Web Mining**	8
	Text mining: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Feature vector, Bag of words, Tf-idf, Text Mining Approaches, Web mining: Introduction, web content mining, web usage mining, web structure mining, web crawlers.	
VI	**Reinforcement Learning and Big Data Mining**	5
	Reinforcement learning- Introduction to reinforcement and wholistic learning, multi-perspective decision making for Big data and multi-perspective learning for big data , Advanced techniques for big data mining.	

Text Books:

Sl.No.	Text Books
1.	Jiawei Han, Micheline Kamber, "Data mining: concepts and techniques", Morgan Kaufmann Publisher, second edition
2.	G. K. Gupta , "Introduction to Data mining with case studies", PHI, second edition

Reference Books:

Sl.No.	Reference Books
1.	Saumen Charkrobarti, “Mining the Web Discovering Knowledge from Hypertext Data”.
2.	Parag Kulkarni, “Reinforcement and systemic machine learning for decision making”, Wiley. 2012
3.	M. Dunham, “Data mining: Introductory and Advanced topics”, Pearson Education, 2003.
4.	Parag Kulkarni, Sarang Joshi, Meta Brown et. al., ”Mining Unstructured Data: A Big Data Perspective”, PHI, 2015, ISBN: 978-81-203-5116-5

410445A Elective-II:Problem Solving with Gamification

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using gamification
- To apply gamifications for Web Applications
- To apply gamifications for Mobile Applications

Course Outcomes:

- To solve problem in projects
- To develop projects using Gamification
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Gaming Foundations**	6
	Introduction, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.	
II	**Developing Thinking**	6
	Re-framing Context: Communicology, Apparatus, and Post-history, Concepts Applied to Video games and Gamification, Rethinking 'playing the game' with Jacques Henriot, To Play Against: Describing Competition in Gamification, Player Motivation: Powerful Human Motivators, Why People Play, Player types, Social Games, Intrinsic verses Extrinsic Motivation, Progression to Mastery. Case studies for Thinking: Tower of Hanoi.	
III	**Opponent Moves in Gamification**	8
	Reclaiming Opposition: Counter gamification, Gamed Agencies: Affectively Modulating Our Screen-and App-Based Digital Futures, Remodeling design, Game Mechanics, Designing for Engagement, Case study of Maze Problem.	
IV	**Game Design**	8
	Game Mechanics and Dynamics: Feedback and Re-enforcement, Game Mechanics in depth, Putting it together, Case study of 8 queens problem.	
V	**Advanced tools, techniques**	6
	Gamification case Studies, Coding basic game Mechanics	
VI	**Advanced tools, techniques and applications**	6
	Instant Gamification Platforms, Mambo.io(Ref:http://mambi.io), Installation and use of BigDoor (Open Source http://bigdoor.com),ngageoint/gamification-server (ref: https://github.com/ngageoint/gamification-server)	

Text Books:

Sl.No.	Text Books
1.	http://projects.digital-cultures.net/meson-press/files/2014/06/9783957960016-rethinking-gamification.pdf, ISBN (PDF): 978-3-95796-001-6, Mathias Fuchs, Sonia Fizek,Paolo Ruffino, Niklas Schrape, Rethinking Gamification, Meson Press, ISBN (Print): 978-3-95796-000-9
2.	ftp://ftp.ivacuum.ru/i/WooLF/% 5B2011%5D%20Gamification%20by%20Design.pdf, Gabe Zechermann, Christopher Cunningham, Gamification Design, Oreilly, ISBN: 978-1-449-39767-8.

Reference Books:

Sl.No.	Reference Books
1.	Sarang Joshi, Parikshit Mahalle,"Design and Analysis of Algorithm", Cambridge University Press
2.	http://press.etc.cmu.edu/files/MobileMediaLearning-DikkersMartinCoulter-web.pdf

410445B Elective-II: Pervasive Computing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To introduce pervasive computing abilities.
- To introduce tools and techniques used while solving problems using pervasive computing.
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem pervasive computing abilities.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Introduction to Pervasive Computing**	7
	Concept of Distributed Computing, Mobile Computing, Pervasive Computing, Wearable Computing, Modeling the Key Ubiquitous/Pervasive Computing Properties (Ref: WileyUC), Mobile Adaptive Computing (Ref: TMH), Mobility Management and Caching (Ref:TMH)	
II	**Pervasive Computing Devices**	7
	Smart Environment : CPI and CCI (Smart Devices : Application and Requirements (Ref:Wiley UC), Device Technology and Connectivity (Ref: Pearson PC), Human Computer Interaction (Ref: Unit III,Wiley UC)	
III	**Human Computer Interaction**	6
	Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models (ref: Wiley UC)	
IV	**Middleware for Pervasive**	7
	Adaptive middleware, Context aware middleware, Mobile middleware, Service Discovery, Mobile Agents (Ref: Gupta TMH; Chapter 4, 5, 6)	
V	**Security in Pervasive Computing**	6
	Security and Privacy in Pervasive Networks, Experimental Comparison of Collaborative Defense Strategies for Network Security.	
VI	**Challenges and Outlook**	6
	Overview of challenges, smart devices, Smart Interaction, Smart physical environment device interaction, Smart human-device interaction, Human Intelligence versus machine intelligence, social issues. Case Study- Wearable Computing/ Cyber Physical System.	

Text Books:

Sl.No.	Text Books
1.	Stefan Poslad, Ubiquitous Computing, Smart devices, environment and interaction, Wiley.
2.	Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw Hills

Reference Books:

Sl.No.	Reference Books
1.	Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schaeck, Pervasive Computing, Pearson, Eighteenth Impression, 2014.
2.	Books and Digital Content Developed by the BoS

410445C Elective-II: Embedded Security

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To learn Embedded Security in Portable Computing
- To Learn advances in security in Embedded Technology, IoT
- To study algorithmic examples in distributed environments

Course Outcomes:

- To solve problem in projects
- To develop SRS in the projects
- To solve Embedded Security problems

Unit	Content	Hrs
I	**Introduction**	6
	Cyber security in mobile edge: Three pillars of Mobile Computing, BYOD, Incident Case Study: eBay Data Breach, Target Data Breach, OpenSSL Heartbleed; Strong Authentication, Network Management, Boot Integrity, Hardware-Based Protection, Open-Source Software Best Practice, Third-Party Software Best Practice, Security Development Life cycle, CVSS and its limitations.	
II	**Embedded Solutions: from Management to Security**	8
	Management Engine Overview, Platform and System Management, Intel AMT Overview, The Engine's Evolvement: from Management to Security, Security Applications at a Glance: EPID, PAVP, IPT and Boot Guard; Virtual Security Core: ARM Trust zone: secure and non-secure modes, memory isolation, bus isolation, physical verses virtual isolation . Management Engine vs. Intel AMT,Intel AMT vs. Intel vPro Technology. Building blocks of the security and the management engine: Random number generation, Message Authentication, RSA, Digital Signature, Secure storage, debugging.	
III	**Safeguarding itself**	8
	Access to host memory, Security Requirements, Threat Analysis and Mitigation, Published Attacks: Introducing Ring-3 Rootkits. Intel's Enhanced Privacy Identification (EPID): Redefining Privacy for the Mobile Age, Processor Serial Number, EPID, Sign and Message Authentication(SIGMA)), Implementation of EPID, Applications of EPID, Next generation of EPID	
IV	**Booting**	6
	Introduction, Boot attack: Evil Maid, BIOS and UEFI,BIOS alteration, Software Replacement, rooting, Trusted Platform Module (TPM), Field Programmable Fuses Intel Boot Guard, Measured Boot, Verified Boot. TPM Overview, Intel Platform Trust Technology, Integrated vs. Discrete TPM.	
V	**Hardware-Based Content Protection Technology**	6
	Introduction, Rights protections, Digital rights management (DRM), End-to-End Content Protection, Intel's Hardware-Based Content Protection, Intel Wireless Display, HDCP, Content Protection on TrustZone; Dynamically Loaded Applications:Closed-Door Model, Dynamic Application Loader (DAL) Overview, DAL Architecture, DAl Security Considerations.	
VI	**Embedded Technology: Identity Protection Technology**	6
	Isolated Computing Environment, Security-Hardening Measures, Basic Utilities of embedded security, Anonymous Authentication and Secure Session Establishment, Protected Input and Output, Dynamic Application Loader(DAL), Summary of Firmware Ingredients, Software Guard Extensions, Intel Unifies and Simplifies Connectivity, Security for IoT, Embedded Security for Internet of Things(Ref 2)	

Text Books:

Sl.No.	Text Books
1.	Xiaoyu Ruan, Platform Embedded Security Technology Revealed, APress Open, 2014 ISBN 978-1-4302-6571-9 ebook: platform embedded security technology revealed pdf

Reference Books:

Sl.No.	Reference Books
1.	Edward Lee, Sanjit Seshia, Introduction to Embedded Systems: A Cyber physical Systems Approach, ISBN 978-0-557-70857-4
2.	Digital Content: Arijit Ukil,Jaydip Sen, Sripad Koilakonda,Embedded Security for Internet of Things, Innovation labs TCS, IEEEXplore

410445D Elective-II: Multidisciplinary NLP

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem in projects
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Natural Language Processing**	6
	Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Ambiguity resolution. Lexical Knowledge Networks, Metaphors	
II	**Advanced Natural Language Processing**	6
	Automatic Morphology Learning , Named Entities; Maximum Entropy Models; Random Fields, Estimation Techniques, and Language Modeling , Parsing and Syntax, The EM Algorithm in NLP , Stochastic Tagging, and Log-Linear Models, Probabilistic Similarity Measures and Clustering , Machine Translation, Discourse Processing: Segmentation	
III	**Machine Learning and NLP**	8
	Finite State Machine Based Morphology; Automatic Morphology Learning; Finite State Machine Based Morphology , Unsupervised Methods in NLP, Introduction to HMM, HMM Ergodic models, Morphology, Graphical Models for Sequence Labeling in NLP, Probabilistic parsing; sequence labeling, Forward Backward probability; Viterbi Algorithm	
IV	**Introduction to Speech Communication**	6
	Speech Communication : Biology of Speech Processing The Acoustics and Acoustic Analysis of Speech , Linguistic level, Physiological level, Acoustic level, Auditory physiology, The Physiology of Speech Production ,Sentence-level Phenomena, The Perception of Speech, Speech Disorders and Development, Speech Synthesis	
V	**Multidisciplinary Natural Language Processing**	6
	Lexical Knowledge Networks, WordNet Theory; Indian Language WordNets and Multilingual Dictionaries; Semantic Roles, Word Sense Disambiguation Multilinguality, Metaphors	
VI	**Advanced tools, techniques and applications of NLP**	8
	Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval, Some applications like machine translation, database interface, Programming language Python Natural Language Tool Kit (NLTK), NLP applications in web mining and text mining.	

Text Books:

Sl.No.	Text Books
1.	Jurafsky, David, and James H. Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Upper Saddle River, NJ: Prentice-Hall, 2000. ISBN: 0130950696.
2.	Manning, Christopher D., and Hinrich Schütze. Foundations of Statistical Natural Language Processing. Cambridge, MA: 1999. ISBN: 0262133601.
3.	Stevens, K. N. Acoustic Phonetics. Cambridge, MA: MIT Press, 1999. ISBN: 9780262194044

Reference Books:

Sl.No.	Reference Books
1.	Flanagan, J. L. Speech Analysis, Synthesis and Perception. 2nd ed. New York, NY: Springer-Verlag, 1972. ISBN: 9780387055619.
2.	Kent, Raymond D., Bishnu S. Atal, and Joanne L. Miller, eds. Papers in Speech Communication: Speech Production.New York,NY: Acoustical Society of America,1991. ISBN: 9780883189580.
3.	G. Chirchia and S. McConnell Ginet.Meaning and Grammar, MIT Press, 1990.
4.	Jaes Allen.Natural Language Understanding, Benjamin-Cummins, 1987.

410446 Computer Laboratory-I

Teaching Scheme
Practicals: 4 Hrs/Week

Examination Scheme
Oral Assessment: 50
Practical Assessment : 50

Course Objectives:

- To develop problem solving abilities using Mathematical Modeling
- To apply algorithmic strategies, Software Engineering and Testing while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To demonstrate efficient design, analysis and testing of algorithmic assignments.
- To debug and demonstrate the Testing of functioning using Software Engineering for OO programming.
- To effectively use multi-core or distributed, concurrent/Parallel environments.

Tools:

64-bit Fedora or equivalent OS with 64-bit Intel-i5/ i7 or latest higher processor computers, FOSS tools, LEX, YACC, DAG, iburg, XMLVM, Intel Internet of Things (IoT) Developer Kit or Intel Galileo board or BBB or Open Source equivalent, VxWorks®, the real-time operating system (RTOS) for IoT, NS3,scala, Sqoop, Pig(Latin, Compiler), Hive, HDFS, HBase.

Evaluation and Term-work Assessment Method: Practical, Oral and Term work Assessment Scheme guidelines are to be used for evaluation.

A. Each Assignment/Class Designed must have Mathematical modeling using relevant Divide-n-Conquer strategies to be assessed for 10% of the Marks (Paper Work/Digital Write-up);

B. In A above, an ability demonstrated for eliminating the redundant Conditional statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

C. In A above, an ability demonstrated for eliminating the redundant Loops statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

D. The functioning of the programs is to be demonstrated by Black-Box Testing for 10% of the Marks;

E. White-Box Walk through Testing methods for 10% of the marks;

F. Positive-Negative testing for 10% of the marks;

G. In addition to these testing methods, student must select one of the advanced Software Testing method currently practiced in the Industry which is suitable for the functional assignment of the Reliability for 10% of the marks.

H. 10% of the marks are to be given for the Oral Questions using above.

I. 10% of the marks are to be given for the output generated for the practical/Oral/Term work.

J. The assessment as above is to be done by a pair of examiners as per prevailing rules of SPPU examination and items A,B,E by Examiner 1 and items C,D,F by Examiner 2 and items G,H,I to be assessed Jointly;

K. Latex or its equivalent be used to generate the document to be stored in the Read-only Digital Media as a term-work/Digital Journal after checking, removing/ avoiding the plagiarism. Give an additional assignment per assignment reporting plagiarism to be submitted in the journal under the heading extra-work.

L. Examination to be conducted on the assignments performed (Group A and Group-B).

Laboratory Assignments:

- **Group A (Mandatory Six Assignments)**

1. Using Divide and Conquer Strategies design a function for Binary Search using C++/ Java/ Python/ Scala.
2. Using Divide and Conquer Strategies design a class for Concurrent Quick Sort using C++.
3. Lexical analyzer for sample language using LEX.
4. Parser for sample language using YACC.
5. Int code generation for sample language using LEX and YACC.

Elective-I A. Design a class using C++ to read a gray scale TIFF image file of a dental digital X-Ray or Medical X-Ray or an Areal view Image, design Class to calculate histogram to return a CList, Design ImageDisplay class to display historam of a image.

Elective-I B. A company has three offices at remote locations with requirement of interoperability with remote services. Each office has a server, TCP/IP and different users including administrator, privileged users and common clients. Design a network model for the same. Demonstrate the network model using NS3.

Elective-I C. Write a java program to multiply 64-bit numbers using shared memory, java collection framework and java utilities.

Elective-I D. Implement a simple approach for k-means/ k-medoids clustering using C++.

- **Group B (Any Six Assignments: atleast 3 from the selected Elective)All assignments must be covered in a students batch of laboratory.**

1. 8-Queens Matrix is Stored using JSON/XML having first Queen placed, use back-tracking to place remaining Queens to generate final 8-queen's Matrix using Python.
2. Concurrent Implementation of travelling salesman problem.
3. Implementation of 0-1 knapsack problem using branch and bound approach.
4. Code optimization using DAG.
5. Code generation using DAG / labeled tree.
6. Generating abstract syntax tree using LEX and YACC.
7. Implementing recursive descent parser for sample language.
8. Write a program to implement SLR Parsing algorithm using Python for the ordered input Set in XML { P→ E, E→E+T, E→T, T→T*F, T→F, F→(E), F→i, END. }

Elective-I A1 Implement histogram equalization without the use of FOSS Eclipse-OpenCV library functions and compare its performance to OpenCV library function with Eclipse.

Elective-I A2 Implement adaptive thresholding of a gray scale image and compare its performance with ordinary thresholding .

Elective-I A3 Perform a two dimensional Butterworth low-pass and high-pass filter of the given image for two different cut-off frequencies.

Elective-I A4 Perform Image segmentation using watershed /fuzzy/clustering segmentation technique.

Elective-I A5 Perform any two boundary/region based feature extraction techniques for object recognition.

Elective-I B1 Write a program in python to calculate end-to-end packet delay for ethernet, 802.11 and 802.15.4 and compare the results. End-to-end packet delay should include processing delay, queuing delay, transmission delay and propagation delay.

Elective-I B2 Write a program in Java to analyze M/D/1 (Random Arrivals, constant service time distribution and 1 server) for data wireless networks and calculate channel utilization and throughput.

Elective-I B3 Write a program using Embedded Java to find CMST using Esau-Williams Algorithm use wireless networks.

Elective-I B4 For wireless routing, design and compare distributed Bellman-Ford algorithm and Dijkstra's algorithm use FOSS Eclipse C++/ Java/ Python/ Scala for programming.

Elective-I B5 The class rooms and laboratories are connected through a distributed network having 'n' nodes with security cameras (IP-based) along with the other sensors such as thumb marks of attendance. Design a network for your college for security management and attendance management. The departments are connected in a bipartite graph and Heads are connected to the administrative offices of the college. Design a network and test it the efficient data handling by different entities. Develop a model to demonstrate Dijkstra's algorithm for sampling the data. Use Python and NS3.

Elective-I C1 For a text message of 150 words, Huffman Codes are to be produced and transmitted through a messaging system or a blog. Use Python or Java Script/Java Beens to transfer such message from one user to another on a web/intranet.

Elective-I C2 For a text message of 150 words, Huffman Codes are to be produced and transmitted through a messaging system or a blog. Use Python or Java Script/Java Beens/Scala to transfer such message from one user to another on a web/intranet, Develop a mobile APP.

Elective-I C3 Write a program using Sqoop to transfer the Digital Library Book Data and related linked to multimedia/PDF files stored using MySQL to HDFS and from HDFS to MySQL.

Elective-I C4 Write a program using Hive to create a summarization and data analysis queries on the Digital Library Book Data.

Elective-I C5 Write a MapReduce program using Java/Python/Scala to arrange the data on userid, then with in the user id sort them in increasing or decreasing order of hit count of accession number demanded by students using digital library.

Elective-I D1 Using any similarity based techniques develop an application to classify text data. Perform pre-processing tasks as per requirement.

Elective-I D2 Implement Apriori approach for datamining to organize the data items on a shelf using following table of items purchased in a Mall

Transaction ID	Item1	Item2	Item3	Item4	Item 5	Item6
T1	Mnago	Onion	Jar	Key-chain	Eggs	Chocolates
T2	Nuts	Onion	Jar	Key-chain	Eggs	Chocolates
T3	Mnago	Apple	Key-chain	Eggs	-	-
T4	Mnago	Toothbrush	Corn	Key-chain	Chocolates	-
T5	Corn	Onion	Onion	Key-chain	Knife	Eggs

Elective-I D3 Implement Decision trees on Digital Library Data to mirror more titles(PDF) in the library application, compare it with Naïve Bayes algorithm.

Elective-I D4 Implement Naïve Bayes for Concurrent/Distributed application. Approach should handle categorical and continuous data.

Elective-I D5 Implementation of K-NN approach take suitable example.

- Group C (Any One Assignment)

1. Code generation using "iburg" tool.
2. Cross compilation using XMLVM.
3. Generate Huffman codes for a gray scale 8 bit image.
4. Simulate JPEG like compression on a grayscale image and report the compression ratio.

Text Books:

Sl.No.	Text Books
1.	Laboratory Manual generated by the Laboratory Teachers of the respective college, in the Term-work Format; to be assessed and approved by the BoS
2.	Content in Digital Library

410447 Computer Laboratory-II

Teaching Scheme
Practicals: 4 Hrs/Week

Examination Scheme
Term Work Assessment: 50
Oral Assessment : 50

Course Objectives:

- To develop problem solving abilities for smart devices.
- To develop problem solving abilities for gamifications.
- To develop problem solving abilities of pervasiveness,embedded security and NLP.
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- Problem solving abilities for smart devices.
- Problem solving abilities for gamifications.
- Problem solving abilities of pervasiveness,embedded security and NLP.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Tools:

64-bit Fedora or equivalent OS with 64-bit Intel-i5/i7 or latest higher processor computers, FOSS tools, LEX, YACC, DAG, iburg, XMLVM, Intel Internet of Things (IoT) Developer Kit or Intel Galileo board or BBB or Open Source equivalent, VxWorks®, the real-time operating system (RTOS) for IoT, NS3, Scala, Python

Evaluation and Term-work Assessment Method: Practical, Oral and Term work Assessment Scheme guidelines are to be used for evaluation.

A. Each Assignment/Class Designed must have Mathematical modeling using relevant Divide-n-Conquer strategies to be assessed for 10% of the Marks (Paper Work/Digital Write-up);

B. In A above, an ability demonstrated for eliminating the redundant Conditional statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

C. In A above, an ability demonstrated for eliminating the redundant Loops statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

D. The functioning of the programs is to be demonstrated by Black-Box Testing for 10% of the Marks;

E. White-Box Walk through Testing methods for 10% of the marks;

F. Positive-Negative testing for 10% of the marks;

G. In addition to these testing methods, student must select one of the advanced Software Testing method currently practiced in the Industry which is suitable for the functional assignment of the Reliability for 10% of the marks.

H. 10% of the marks are to be given for the Oral Questions using above.

I. 10% of the marks are to be given for the output generated for the practical/Oral/Term work.

J. The assessment as above is to be done by a pair of examiners as per prevailing rules of SPPU examination and items A,B,E by Examiner 1 and items C,D,F by Examiner 2 and items G,H,I to be assessed Jointly;

K. Latex or its equivalent be used to generate the document to be stored in the Read-only Digital Media as a term-work/Digital Journal as per BoS format of Term work Submission after checking, removing/ avoiding the plagiarism. Give an additional assignment per assignment reporting plagiarism to be submitted in the journal under the heading extra-work.

L. Examination to be conducted on the assignments performed (Group A and Group-B).

Laboratory Assignments:

- **Group A (Mandatory Six Assignments)**

1. Implementation of any 2 uninformed search methods with some application.
2. Write a program to perform profile translation-based proactive adaptation using context management in smartphones. Objective of this assignment is to automatically generates user's profile according to the scenarios using machine learning approaches. System should allow to keep user's full profile in user domain resulting into centralizing or exchanging the profile information with increase in the consistency of profile information. .
3. Implement A* approach for any suitable application.
4. Implementation of Unification algorithm
5. Implement Naive Bayes to predict the work type for a person with following parameters: age: 30, Qualification: MTech, Experience: 8
   Following table provides the details of the available data:

Work Type	Age	Qualification	Experience
Consultancy	30	Ph.D.	9
Service	21	MTech.	1
Research	26	MTech.	2
Service	28	BTech.	10
Consultancy	40	MTech.	14
Research	35	Ph.D.	10
Research	27	BTech.	6
Service	32	MTech.	9
Consultancy	45	Btech.	17
Research	36	Ph.D.	7

Elective-II A. Implementation of any 2 informed search methods for a Three LPG companies that wants to install a gas pipe-line between five cities. The cost of pipeline installation is given in a table maintained using XML/JSON use C++/ Python/ Java/ Scala with Eclipse for the application. Calculate time and space complexities. Use concepts of gamification, define necessary rules of the gamification.

Elective-II B. A Pizza shop chain wants to automate dishes served with schemes or without scheme and delivered by the nearest shop in a chain. Use pervasive computing paradime to develop a web-application using Embedded Java/ Pythone/ Scala so that the order be delivered to the customer within 10 minutes. Use XML/JSON to store the data.

Elective-II C. Using Python/Java with BBB develop a embedded security application of a door lock.

Elective-II D. Write a program using Scala/ Python/ C++ using Eclipse to correct the spelling of English paragraph.

- **Group B (Any Six Assignments: atleast 1 from the selected Elective)All assignments must be covered in a students batch of laboratory.**

1. Write a program to build smart mobile app for context management. Objective of this assignment is to build a smart app form smart phone which can sense some parameters of the user and convert this parameters into some contextual information in order to do the context management.
2. Write a program to build smart mobile app for user profiling. Objective of this assignment is to develop smart mobile app which can create user profiles based on their preferences so that smart recommendations cab be provided at run time.

3. Implementation of MiniMax approach for TIC-TAC-TOE using Java/ Scala/ Python-Eclipse Use GUI Player X and Player O are using their mobiles for the play. Refresh the screen after the move for both the players.

4. Implementation of a simple NN for any suitable application (without tool)

5. Implementation of any 2 uninformed search methods for a LPG company that wants to install a gas pipeline between five cities. The cost of pipeline installation is given in a table maintained using XML/JSON use C++/ Python/ Java/ Scala with Eclipse for the application. Calculate time and space complexities.

6. Write a program to perform classification for the sample dataset based on the by using LIBSVM – A Library for Support Vector Machines. (using LDA for dimensionality reduction).

7. Developing an book recommend-er (a book that the reader should read and is new) Expert system or (any other).

8. Develop a POP for scheduling your higher studies exam. Assume suitable data like college submission schedule, college exams, Constraint that a paper publication is must to appear before the exam, a family function at home and so on.

9. Implement k-means for clustering data of children belonging to different age groups to perform some specific activities. Formulate the Feature vector for following parameters:

   i. height
   ii. weight
   iii. age
   iv. IQ

   Formulate the data for 40 children to form 3 clusters.

Elective-II A1 Hints data, Algorithms names data and words data is stored using XML/ JSON/ MongoDB, The game is to select appropriate algorithms of string comparison using multiple hints to display meaningful combination of words. For example, Hints: Pratapgad (Fort)⟨ Historical Place Hint⟩, ⟨ HIstorical Event hint⟩ outcome can be Shri Shivaji Raje, Use Python/ Scala/ Java/ C++. Larger the number of hints lesser the marks for the outcome. There should be large number of combinations in the hints database. Find the Algorithmic Complexity/efficiency.

Elective-II A2 Hints data, Algorithms names data and words data is stored in distributed storage media/HDFS using XML/JSON/MongoDB/hBase, The game is to select appropriate algorithms of string comparison using multiple hints to display meaningful combination of words. For example, Hints: Pratapgad (Fort)⟨ HIstorical place hint⟩, ⟨ Historical event hints⟩ outcome can be Shri Shivaji Raje, Use Python/ Scala/ Java/ C++. Larger the number of hints lesser the marks for the outcome. There should be large number of combinations in the hints database.

Elective-II A3 Hints data, Algorithms names data and words data is stored in distributed storage media/HDFS using XML/JSON/MongoDB/hBase, The game is to select appropriate algorithms of string comparison using multiple hints to display meaningful combination of words. For example, Hints: Pratapgad (Fort)⟨Historical Location hint⟩, ⟨Historical Event hint⟩ outcome can be Shri Shivaji Raje, Use Python/ Scala/ Java/ C++. Larger the number of hints lesser the marks for the outcome. There should be large number of combinations in the hints database. Use Concurrent searching and Merging algorithms. Find the efficiency/Complexity.

Elective-II A4 Hints data, Algorithms names data and words data is stored in distributed storage media/HDFS using XML/JSON/MongoDB/hBase, The game is to select appropriate algorithms of string comparison using multiple hints to display meaningful combination of words. For example, Hints: Pratapgad (Fort) ⟨ Historical Location hint⟩, ⟨Historical Event hint⟩ outcome can be Shri Shivaji Raje, develop Python/ Scala/ Java Mobile App. Larger the number of hints lesser the marks for the outcome. There should be large number of combinations in the hints database. Use Concurrent searching and Merging algorithms. Find the efficiency/Complexity.

Elective-II A5 Elective teacher can frame suitable distributed programming application using wireless networks and smart devices equivalent to A1/A2/A3/A4 above.

Elective-II B1 In a rolling display program of news display on a smart TV or Computer Display the input strings are supplied by the mobile phone. Develop necessary app using Scala/ Python/ Java/ C++.

Elective-II B2 In a rolling display program of news display on a smart TV or Computer Display the input strings are supplied by another computer connected through wireless networks.Develop necessary app using Scala/ Python/ Java/ C++.

Elective-II B3 The BBB (Beagale Bone Black) is used in a Samrt CAR to rotate the steeper motor of a glass window by programmable angle, use model as a HOTSPOT device to transfer the Computer/Internet/Intranet page data of angle of rotation. Write a distributed application using JSON/ xml and Java/ Scala/ Python/ C++.

Elective-II B4 Elective teacher can frame suitable distributed programming application using wireless networks using Pervasive environment equivalent to B1/B2/B3 above.

Elective-II C1 Using Python/Java with BBB development board write a embedded security application of a password based door lock(stepper motor can be used with Photo diode or use LEDs. Use Mobile/ laptop/ desktop as a hotspot device/ Bluetooth device to lock or unlock the door.

Elective-II C2 Write a mobile app using Scala/ Python/ C++/ Android using Eclipse to beep the mobile speaker for three incorrect attempts of the password.

Elective-II C3 Elective teacher can frame suitable distributed programming application using wireless networks and smart devices in distributed environment equivalent to C1/C2 above.

Elective-II D: Using Programming language Python and Natural Language Tool Kit (NLTK) perform the following:

Elective-II D1 Apply Simple language processing for 10 phonetics Indian languages (Marathi or mother-tongue)

Elective-II D2 Lab on Sound Propagation.

Elective-II D3 Lab on Quantifying the Perception of Sound.

Elective-II D4 Lab on the Acoustic Analysis of Speech.

- **Group C (Any One Assignment)**

1 Study and implementation of research paper in Multidisciplinary NLP using open source tool

2 Write a program to Smart Watch App Development with Tizen. Objective of this assignment is to design simple comic app with the Tizen SDK for Wearable and run it on the smart watch emulator that comes bundled with the IDE.

Text Books:

Sl.No.	Text Books
1.	Laboratory Manual generated by the Laboratory Teachers of the respective college, in the Term-work Format; to be assessed and approved by the BoS
2.	Content in Digital Library

410448 Project

Teaching Scheme
Tutorial: 2 Hrs/Week

Examination Scheme
Term Work Assessment: 50

Course Objectives:

- To develop problem solving abilities using mathematics;
- To apply algorithmic strategies while solving problems;
- To develop time and space efficient algorithms;
- To develop software engineering documents and testing plans;
- To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments.
- To encourage and expose students for participation in National/ International paper presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities.

Course Outcomes:

- To solve problem in projects;
- To develop SRS and other software engineering documents in the project report;
- To solve problems using multi-core, distributed, embedded, concurrent/Parallel environments;
- To write conference paper;
- To demonstrate presentation, communication and team-work skills.

Tools:

Preferably 64-bit FOSS tools but if sponsoring company's requirement is non-open source platform then it must be latest and current version of non-absolute tools. 64-bit i5/i7/ Desktops/Mobiles, Latest SAN,
3-tier architectures along with latest version of FOSS Operating systems like Fedora 21 or equivalent, LAMP tools, WEB server, Applications servers, Database servers, MongoDB or latest open source BigDATA tools, FOSS Programming Tools like gcc,g++,Eclipse, Python, Java and other tools are as per the requirement of the SRS. The documentation tools like Open office, GIT, Latex, Latex-Presentation.

Activity Planning for Tutorial Sessions:

I Selection of Project Option and Framing the Problem to solve as a Project for the group of 3 to 4 students.
Option A: Industry Sponsored Project
Option B: Project as a Entrepreneur
Option C: Internal Project

II Internal guide allocation for the BE Project: Assistant Professor/Associate Professor/Professor as per AICTE norms in computer engineering having atleast 5 years of full time approved experience can guide the BE Project without compromising on the quality of the work(ref. Note1). The Project laboratory of 4 project groups (3 to 4 students in one group) constituting one laboratory tutorial batch (2 hrs per week), be allocated to the guide. The project group will submit the synopsis including title of the project, Technical Key Words (Ref. ACM Keywords) and relevant mathematics associated with the Project, names of atleast two conferences, where papers can be published, Review of Conference/Journal papers (atleast 10 papers + White papers or web references, (if any)) supporting the project idea, Plan of project execution using planner or alike project management tool.(Recommended dates: 3 weeks after Commencement of the Term). Preferably, the projects are Industry Sponsored or part of high level research/ Sponsored Research Project that are not conducted for any award of the educational degree or entrepreneurship project.

III The project conduct and procedures are amended as detailed below:- Problem statement feasibility assessment using, satisfiability analysis and NP-Hard, NP-Complete or P type using modernalgebra and relevant mathematical models.(recommended date of submission:- 8 weeks before term end)

IV Use of above to identify objects, morphism, overloading, functions and functional relations and any other dependencies. (recommended submission date:- 6 weeks before term end) Functional dependency graphs and relevant UML diagrams or other necessities.(recommended submission date:- 3 weeks before term end)

V Testing of problem statement using generated test data (using mathematical models, Function testing principles) selection and appropriate use of testing tools, testing of UML diagram's reliability. (recommended submission date:- two weeks before term end)

VI The index of submission must cover above mentioned 5 heads in addition to the instructions by the guide. Students must submit a Latex Report consisting of problem definition, literature survey, platform choice, SRS (System Requirement Specification) Document in specific format and high-level design document along with Annex A: Laboratory assignments on Project Analysis of Algorithmic Design, Annex B: Laboratory assignments on Project Quality and Reliability Testing of Project Design at the end of term-I and Annex C: Project Planner and progress report **after checking, removing/ avoiding the plagiarism. Give an additional assignment per reporting plagiarism to be submitted in the report under the Annex heading extra-work. If the project is the replica of any other previous project or work from other unrelated persons than the students team, such project should be rejected for the term work.**
The term work at the end of Term-I shall be assessed and evaluated for 50 marks by the panel of examiners in the subject (Internal (preferably guide) and external examiner from Computer Department of Engineering Colleges). At-least one technical paper must be submitted on the project design in the conferences/workshops in IITs, Central Universities or UoP Conferences or equivalent International Conferences Sponsored by IEEE/ACM and review comments received as Annex D. The examiners must seek answers regarding the suggestions given in the review comments of the paper submitted.

Term-I Project Laboratory Assignments: Tutorial Session

1. Refer Chapter 7 of first reference to develop the problem under consideration and justify feasibilty using concepts of knowledge canvas and IDEAMatrix.

2. Project problem statement feasibility assessment using NP-Hard, NP-Complete or satisfiability issues using modern algebra and/or relevant mathematical models.

3. Use of divide and conquer strategies to exploit distributed/parallel/concurrent processing of the above to identify objects, morphisms, overloading in functions (if any), and functional relations and any other dependencies (as per requirements).

4. Use of above to draw functional dependency graphs and relevant Software modeling methods, techniques including UML diagrams or other necessities using appropriate tools.

5. Testing of project problem statement using generated test data (using mathematical models, GUI, Function testing principles, if any) selection and appropriate use of testing tools, testing of UML diagram's reliability.

For Entrepreneurship type project additional assignments: Tutorial Session

6. To sign the MoU/agreement with the Engineering College for the Industry-on-Campus. The college shall provide the company the enclosure with lock-and-key to accommodate required table space, stabilized electricity and the Internet access. The College may host such company for first two years and further by renewing the MoU/Agreement. The college shall provide all such documents necessary for the establishment of the company. The College shall provide all the facilities as per agreement for Rent FREE, without any charges or fees or returns whatsoever for the First Year or Academic Duration of the activity. The college may prepare joint proposal with company for the AICTE/Government/University grants if any.

7. To study and establish a partnership company/proprietorship and get the PAN, MVAT, Profession Tax Number and such other necessary legal permissions.

8. Try and prepare clients list and communication with the clients or advertise the product by developing the Company WEB Site.

9. To submit Product Proposal for raising venture capital through government schemes of micro/small sector industries or through private venture capital entities.

10. To submit National/International patent/Copyright for first year to the Government Department of Patents and IPR.

Note 1. **The guide for an entrepreneurship project shall be a full time approved Professor or Associate Professor possessing qualifications as per AICTE norms.**

Note 2. **If the students fails to complete the entrepreneurship assignments successfully then the project shall be treated as Internal Project for the purpose of assessment.**

Note 3. **All projects are expected to exploit multi-core, embedded and distributed computing wherever possible.**

Reference Books:

Sl.No.	Reference Books
1.	Dr. Parag Kulkarni, "Knowledge Innovation Strategy", Bloomsbury Publication, ISBN: 978-93-84898-03-8, 2015
2.	Dr. P.K. Sinha et.al., Electronic Health Record, IEEE Press Wiley ISBN: 978-1-118-28134-5
3.	McKinsey report: Big data: The next frontier for innovation, competition, and productivity (PDF)
4.	Web Resource: http://www.mckinsey.com/insights ... digital competition
5.	Web Resource: http://msme.gov.in/mob/home.aspx

Semester-II
410449 Software Design Methodologies and Testing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To understand and apply different design methods and techniques
- To understand architectural design and modeling
- To understand and apply testing techniques
- To implement design and testing using current tools and techniques in distributed, concurrent and parallel environments

Course Outcomes:

- To choose and apply design techniques for software system
- To design and model using UML for a given software system
- To design test cases and implement automated testing for client server, Distributed, mobile applications

Unit	Content	Hrs
I	**Concepts**	6
	Introduction to software Design,Design Methods:Procedural and Structural Design methods,Object Oriented design method,Unified modeling Language overview, Static and Dynamic Modeling - Advance Use case, Class,State,Sequence Diagrams	
II	**Architectural Design**	6
	Architectural Design,importance and architecture views,client-server ,service oriented, component based concurrent and real time software architecture with case studies	
III	**Introduction to Design Patterns**	8
	Design Patterns;Introduction,creational,Structural and behavioral patterns,singleton,proxy,adapter,factory,iterator,observer pattern with application	
IV	**Principles of Software Testing**	6
	Testing concepts, Principles of software testing, verification and validation, V-test model, defect management	
V	**Testing Strategies**	8
	Testing strategies, unit, integration and system testing , acceptance, alpha,beta, performance, security testing ,white box and black box testing, basis path testing, equivalence testing, graph base testing,test metric and report	
VI	**Advanced Techniques and Tools**	4
	GUI testing ,functional testing, Automated testing tools, features, selection, mobile testing, testing tools like selenium ,Junit, monkey talk	

Text Books:

Sl.No.	Text Books
1.	HASSAN GOMAA, Software Modeling and Design, Cambridge university Press, 2011, ISBN-13 978-1-107-44735-6
2.	Erich Gamma, Richard Helm,Ralph Johnson ,John Vlissides, Design patterns Elements of Reusable Object-Oriented Software
3.	Srinivasan Desikan, "Software Testing Principals and practices", Pearson Publication ISBN-13 978-8-17-758295-6

Reference Books:

Sl.No.	Reference Books
1.	Grady Booch,James Rumbaugh,Ivar Jacobson, The UML Users Guide, Pearson Publication 2013 print ISBN-13-978817758372-4

410450 High Performance Computing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using HPC
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- Transform algorithms in the computational area to efficient programming code for modern computer architectures
- Write, organize and handle programs for scientific computations
- Use tools for performance optimization and debugging
- Analyze code with respect to performance and suggest and implement performance improvements
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Parallel Processing Concepts**	8
	Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Organization and Contents of the Text, Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor & Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines Levels of parallelism (instruction, transaction, task, thread, memory, function) Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation) Architectures: N-wide superscalar architectures, multi-core, multi-threaded	
II	**Parallel Programming**	8
	Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architecture examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Micro architecture and Intel Nehalem micro-architecture Memory hierarchy and transaction specific memory design, Thread Organization	
III	**Fundamental Design Issues in HPC**	6
	Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, One-Dimensional Matrix-Vector Multiplication, Single-Source Shortest-Path, Sample Sort, Groups and Communicators, Two-Dimensional Matrix-Vector Multiplication	
IV	**Synchronization and related algorithms**	6
	Synchronization: Scheduling, Job Allocation, Job Partitioning, Dependency Analysis Mapping Parallel Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming	

V	**Advanced tools, techniques and applications**	6
	Bandwidth Limitations, Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations, Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Sorting: Issues, Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort, Shared-Address-Space Parallel Formulation, Single -Source Shortest Paths- Distributed Memory Formulation	
VI	**HPC enabled Advanced technologies**	6
	Search Algorithms for Discrete Optimization Problems: Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Introduction to (Block Diagrams only if any) Petascale Computing, Optics in Parallel Computing Quantum Computers, Recent developments in Nanotechnology and its impact on HPC Power-aware Processing Techniques in HPC	

Text Books:

Sl.No.	Text Books
1.	Kai Hwang,"Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill 1993
2.	David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann,1999.

Reference Books:

Sl.No.	Reference Books
1.	Kai Hwang,, "Scalable Parallel Computing", McGraw Hill 1998.
2.	George S. Almasi and Alan Gottlieb, "Highly Parallel Computing", The Benjamin and Cummings Pub. Co., Inc
3.	William James Dally and Brian Towles, "Principles and Practices on Interconnection Networks", Morgan Kauffman 2004.
4.	Hubert Nguyen, GPU Gems 3 - by (Chapter 29 to Chapter 41)
5.	Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Welsey, © 2003
6.	David A. Bader (Ed.), Petascale Computing: Algorithms and Applications, Chapman & Hall/CRC Computational Science Series, © 2007.

410451A Elective-III: Mobile Computing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mobile Computing
- To study foundations of Mobile Computing

Course Outcomes:

- To solve problem using Mobile Computing

Unit	Content	Hrs
I	**Fundamental of Wireless and basics of wireless network**	6
	Digital communication, wireless communication system and limitations, wireless media, frequency spectrum, technologies in digital wireless communication, wireless communication channel specification, wireless network, wireless switching technology, wireless communication	
II	**Mobile Communications and Computing**	7
	An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital Music Players, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems,Limitations of Mobile Devices, Automotive Systems.	
III	**GSM and other architectures**	6
	GSM-Services & System Architectures ,Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, multiplexing, controlling the medium access, spread spectrum, coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.	
IV	**Mobile Network and Transport Layer**	7
	IP & Mobile IP Network Layers, Packet Delivery & Handover Management, Location Management, Registration, Tunneling & Encapsulation, Route Optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks(MANET), Routing and Routing Algorithms in MANET, security in ad-hoc networks.	
V	**Data Dissemination and Data Synchronization in Mobile Computing**	7
	Communication Asymetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.	
VI	**Mobile Devices and Mobile Operating System**	6
	Mobile agent, applications framework, application server, gateways, service discovery, device management, mobile file system, Mobile Operating Systems, Characteristics, Basic functionality of Operating Systems: Window 8, iOS, Android OS.	

Text Books:

Sl.No.	Text Books
1.	Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi
2.	Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks, concepts and protocols, Wiley, India.

Reference Books:

Sl.No.	Reference Books
1.	Andrew Tanenbaum, Modern Operating System, 3rd/e, Pearson Education International, ISBN Q-lB-filBMST-L
2.	Digital Content: iOS Technology Overview: IOSTechOverview.pdf, Apple Inc. Copyright 2014

410451B Elective-III: Web Technology

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To Learn advanced Web Technologies
- To apply technologies while solving problems

Course Outcomes:

- To use technologies for solving problems in projects

Unit	Content	Hrs
I	**IoT Web Technology**	6
	The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardisation, Recommendations on Research Topics.	
II	**IoT Applications for Value Creation**	6
	Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	
III	**Internet of Things Privacy, Security and Governance**	6
	Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	
IV	**Architectural Approach for IoT Empowerment**	8
	Introduction, Defining a Common Architectural Ground, IoT Standardisation, M2M Service Layer Standardisation, OGC Sensor Web for IoT, IEEE, IETF and ITU-T standardization activities, Interoperability Challenges, Physical vs Virtual, Solve the Basic First, Data Interoperability, Semantic Interoperability, Organizational Interoperability, Eternal Interoperability, Importance of Standardisation, Plan for validation and testing, Important Economic Dimension, Research Roadmap for IoT Testing Methodologies. Semantic as an Interoperability Enabler and related work.	
V	**Identity Management Models in IoT**	8
	Introduction, Vulnerabilities of IoT, Security requirements, Challenges for a secure Internet of Things, identity management, Identity portrayal, Different identity management model: Local identity, Network identity, Federated identity, Global web identity, Identity management in Internet of Things, User-centric identity management, Device-centric identity management, Hybrid identity management.	
VI	**Trust Management in IoT**	6
	Introduction, Trust management life cycle, Identity and trust, Third party approach, Public key infrastructure, Attribute certificates, Web of trust models, Web services security, SAML approach, Fuzzy approach for Trust, Access control in IoT, Different access control schemes, Authentication and Access control policies modelling.	

Text Books:

Sl.No.	Text Books
1.	Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013, ISBN: 978-87-92982-96-4 (E-Book), ISBN: 978-87-92982-73-5 (Print)
2.	Dr. Parikshit Mahalle, Poonam Railkar, Identity Management for Internet of Thing, River Publishers, 2015, ISBN: 978-87-93102-91-0 (EBook), ISBN:978-87-93102-90-3(Hard Copy)

Reference Books:

Sl.No.	Reference Books
1.	Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1

410451C Elective-III: Cloud Computing

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To study cloud computing concepts;
- Enhancing cloud computing environment.
- To study various platforms
- To study the applications that uses cloud computing.

Course Outcomes:

- To install cloud computing environments.
- To develop any one type of cloud

Unit	Content	Hrs
I	**Introduction**	6
	Introduction, Roots of Cloud Computing: From mainframe to Cloud, Benefits of Cloud Computing SOA, Web services, Web 2.0, Mashups, Grid computing, Utility computing, Hardware virtualization, Essentials of Cloud characteristics, Challenges, Cloud economics, Role of Networks in Cloud Computing: Cloud types and service models, Cloud computing platforms : Openstack, Opennimbus, Eucalyptus Primary Cloud Service models, Cloud Services brokerage, Primary cloud deployment models, cloud computing reference model, The greenfield and brownfield deployment options	
II	**Virtualization**	8
	Introduction, Characteristics of Virutalized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization, Technology examples: Xen, KVM, Vmware, Microsoft Hyper-V	
III	**Storage in Cloud**	8
	Storage system architecture, Big data, Virtualize data centre(VDC) architecture, VDC Environment, server, storage, networking, desktop and application virtualization techniques and benefits, Virtual Machine Components and Process of converting physical to VMs, Block and file level storage virtualization, Virtual Provisioning, and automated storage tiering, VLAN, VSAN and benifits, Network traffic management techniques in VDC, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Features and comparisons among GFS,HDFS.	
IV	**Cloud computing platforms**	6
	Infrastructure as Service, best-of breed cloud infrastructure components, cloud ready converged infrastructure, Virtual machine provisioning and migration services, Anatomy of Cloud infrastructure, Distributed management of virtual infrastructure, scheduling techniques, SLA Commitment	
V	**Cloud monitoring and management**	8
	Introduction and architecture for federated cloud computing, Performance prediction for HPC on Cloud. SLA management: Types of SLA, Life cycle of SLA, Traditional approaches of SLA. service catalog, service ordering process, management and functional interfaces of services , cloud portal and its functions, cloud interface standards along with SOAP and REST, system integration and work-flow modeling, cloud service life-cycle phases: service planning, service creation, service operation, and service termination Control layer, its functions and benefits,element and unified manager, software defined approach and techniques for managing IT resources	

VI	**Security in Cloud Computing**	6
	Introduction, Global Risk and Compliance aspects in cloud environments and key security terminologies, Technologies for Data security, Data security risk, Cloud computing and identity, Digital identity and access management, Content level security, Security-As-A-Cloud Service	

Text Books:

Sl.No.	Text Books
1.	Rajkumar Buyya, "Cloud computing principles and paradigms", Wiley
2.	Gautam Shroff, Enterprise Cloud Computing, Cambridge
3.	Handbook of Cloud Computing, Springer Publication
4.	Rajkumar Buyya, "Mastering Cloud computing", McGraw Hill
5.	Tim Mather, Subra K, Shahid L.,Cloud Security and Privacy, Oreilly, ISBN-13 978-81-8404-815-5

Reference Books:

Sl.No.	Reference Books
1.	Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication
2.	Greg Schulr,"Cloud and virtual data storage networking",CRC Press
3.	Barrie Sosinsky,"Cloud Computing", Wiley India
4.	Kailash Jayaswal, " Cloud computing", Black Book, Dreamtech Press
5.	Anthony T. Velte, Cloud Computing: A Practical Approach, Tata McGraw Hill, 2009, ISBN: 0070683514
6.	Richard Hill, Guide to Cloud Computing: Principals and Practices, Springer ISBN-10: 1447146026
7.	Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies, Wiley India, 2009, ISBN 8126524871

410451D Elective-III:Cyber Security

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Cyber Security
- To apply algorithmic strategies for cyber security
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem in Cyber Security
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Security Basics**	6
	Introduction, Elements of Information security, Security Policy, Techniques, steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security.	
II	**Data Encryption Techniques and Standards**	8
	Introduction, Encryption Methods: Symmetric, Asymmetric,Cryptography, Substitution Ciphers. Transposition Ciphers, Stenography applications and limitations, Block Ciphers and methods of operations, Feistal Cipher, Data Encryption Standard(DES), Triple DES, DES Design Criteria, Weak Keys in DES Algorithms, Advance Encryption Standard(AES).	
III	**Public Key and Management**	8
	Public Key Cryptography, RSA Algorithm: Working,Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, Message Digest, Kerberos, X.509 Authentication service, Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	
IV	**Security requirements**	8
	Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. IP Security: Introduction, Architecture, IPV6, IPv4, IPsec protocols and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol,VPN. WEB Security:Introduction, Secure Socket Layer(SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher SpecProtocol, Alert Protocol, Handshake Protocol, Secure Electronic Transaction(SET).	
V	**Intrusion and Firewall**	6
	Introduction, Intrusion detection, IDS: Need, Methods, Types of IDS, Password Management, Limitations and Challenges, Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control.	
VI	**Security perspective of Hacking and its counter majors**	6
	Remote connectivity and VoIP hacking, Wireless Hacking, Mobile Hacking, Hacking Hardware, Application and data Hacking, Mobile Hacking, Counter majors:General Strategies, Example Scenario's: Desktop, Servers, Networks, Web, Database, Mobile.	

Text Books:

Sl. No.	Text Books
1.	Dr. V.K. Pachghare, Cryptography and Information Security, PHI, ISBN 978-81-303-5082-3
2.	Nina Godbole,Sunit Belapure, Cyber Security,Wiley India, ISBN:978-81-345-2179-1

Reference Books:

Sl. No.	Reference Books
1.	PDF Digital Content : Stuart McCLURE, Joel Scambray, George Kurtz, Hacking Exposed Network Security Secrets and Solutions, McGrowHill, 2012 ISBN: 978-0-07-178028-5 Digital Ref: http://84.209.254.175/linux-pdf/Hacking-Exposed-7-Network-Security-Secrets.pdf College libraries are requested to purchase the copy
2.	Digital Content Published by the BoS

410452A Elective-IV (Open Elective): Business Analytic and Intelligence

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem in projects
- To develop SRS in the projects
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Concepts with Mathematical treatment**	8
	Introduction to data, Information and knowledge, Decision Support System, Theory of Operational data and informational data, Introduction to Business Intelligence, Defining BI Cycle, BI Environment and Architecture, Identify BI opportunities, Benefits of BI. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization	
II	**Decision Making Concepts**	6
	Concepts of Decision Making, Techniques of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS.	
III	**Data-Warehouse**	6
	Introduction: Data warehouse Modeling, data warehouse design, data-ware-house technology, Distributed data warehouse, and materialized view	
IV	**Data Pre-processing and outliers**	8
	Data Analytics life cycle, Discovery, Data preparation, Preprocessing requirements, data cleaning, data integration, data reduction, data transformation, Data discretization and concept hierarchy generation, Model Planning, Model building, Communicating Results & Findings, Operationalizing, Introduction to OLAP. Real-world Applications, types of outliers, outlier challenges, Outlier detection Methods, Proximity-Based Outlier analysis, Clustering Based Outlier analysis.	
V	**Designing and managing BI systems**	6
	Determining infrastructure requirements, planning for scalability and availability, managing and maintenance of BI systems, managing BI operations for business continuity	
VI	**BI and Data Mining Applications**	6
	Data analytics, business analytics, ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection, BI Applications in Retail Industry.	

Text Books:

Sl.No.	Text Books
1.	R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015. ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2.	Business Process Automation, Sanjay Mohapatra, PHI.

Reference Books:

Sl.No.	Reference Books
1.	Introduction to business Intelligence and data warehousing, IBM, PHI.
2.	Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie, Morgan Kaufmann Publishers 3rd edition.
3.	Building the data Warehouse, William H Inmon, Wiley Publication 4th edition.
4.	Data Mining for Business Intelligence, WILEY
5.	Soumendra Mohanty, Analytics in Practice,Tata McGraw Hill Education, 2011, ISBN-13 978 0 07 0707061
6.	Ken W. Collier,Agile Analytics: Avalue driven Approach to Business Intelligence and Data Warehousing, Pearson Education,2012, ISBN-13 978 8131786826
7.	Donald Miner, MapReduce Design Pattern, O'Reilly, 2012, ISBN 978 9350239810
8.	EMC Educational Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley ISBN-13 978 1118876138

410452B Elective-IV (Open Elective): Operations Research for Algorithms in Scientific Applications

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem in projects
- To develop SRS in the projects
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Introduction to Operation Research**	6
	Origins of OR, Nature, Impact and phases of OR, Operation Research as tool for Decision Support System, Productivity Improvement. Overview of OR Research Techniques.	
II	**Deterministic OR Models**	6
	Formulation of Linear Programming Problem, Linear Programming Models, Assumptions of Linear Programming, Graphical Method of solving LP problem. Simplex method for solving LP problem.	
III	**Linear Programming Extensions**	8
	Introduction and Formulation of Transportation problem, Types of Transpiration problems, Methods of Initial feasible solution, Methods of optimum solution, Unbalanced Transportation problem, Introduction to Assignment problem. Solution of an assignment problem.	
IV	**Decision, Game** & **Queueing Theory**	8
	Formulation of two person, Zero-sum Games, Solving Simple Games, Mixed Strategies, Non-Zero Sum Games. Basic Structure & components of decision, decision criteria, decision trees. Basic characteristics of queueing system, Terminologies & notation, Poisson process of queueing, M/M/1 system queueing model.	
V	**Hybrid OR Models, Project Management PERT** & **CPM**	8
	Assumption and comparison PERT & CPM, Algorithms of PERT CPM Techniques, Fundamentals of Network Model, Guidelines for Network Construction, Critical path Analysis, Methods based on Time Estimates to find critical paths. Concept of Slack & floats in network analysis, Project Evaluation & Review Techniques (PERT).	
VI	**Dynamic Programming**	8
	Terminologies, Multi Decision Process, Bellman's Principles of optimality, Characteristics of Dynamic Programming problems. Dynamic programming Algorithms, Solving LPP using Dynamic Programming Recent development in OR with perspective of Bio-Technology, Nano Technology:	

Text Books:

Sl.No.	Text Books
1.	Hamidy Taha, Operations Research: An Introduction, Pearson, 8th Edition, ISBN: 978-81-317-1104-0
2.	Dr. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co.

Reference Books:

Sl.No.	Reference Books
1.	Kishor Trivedi, Probability & Statistics with Reliability Queuing and Computer Science Applications, PHI, ISBN: 81-203-0508-6

410452C Elective-IV (Open Elective): Mobile Applications

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mobile Applications
- To study mobile programming technology.

Course Outcomes:

- To solve problem in projects
- To develop mobile applications

Unit	Content	Hrs
I	**Introduction**	6
	Mobile Development Importance, Survey of mobile based application development, Mobile myths, Third party frameworks, Mobile Web Presence and Applications, Creating consumable web services for mobile, JSON, Debugging Web Services, Mobile Web Sites, Starting with Android mobile Applications.	
II	**Mobile Web**	6
	Introduction, WAP1, WAP2, Fragmentation Display, Input Methods, Browsers and Web Platforms, Tools for Mobile Web Development.	
III	**Application Architectures and Designs**	8
	Mobile Strategy, Navigation, Design and User Experience, WML, XHTML Mobile Profile and Basics, Mobile HTML5, CSS for Mobile, WCSS extensions, CSS3, CSS for mobile browsers, HTML5 Compatibility levels, Basics of Mobile HTML5: Document Head, Document Body, HTML5 Mobile Boilerplate, the Content, HTML5 Forms: Design, Elements, Attributes, Validation.	
IV	**Devices, Images, Multi-Media**	6
	Device Detection, Client-side Detection, Server-side Detection, Device Interaction, Images, Video, Audio, Debugging and Performance, Content Delivery, Native and Installed Web Apps.	
V	**Advanced Tools, Techniques**	8
	J2ME programming basics, HTML5 Script Extensions,Code Execution, Cloud based browsers, JS Debugging and profiling, Background Execution, Supported Technologies and API,Standard JavaScript Behavior, Java Libraries, Mobile Libraries, UI Frameworks: Sencha Touch, JQueryMobile, Enyo, Montage, iUI, jQTouch, JavaScript Mobile UI Patterns.	
VI	**Advanced Applications**	6
	Geolocation and Maps app, Offline Apps, Storage, and Networks, Distribution and Social Web 2.0	

Text Books:

Sl.No.	Text Books
1.	Jeff McWherter, Scott Gowell, Professional Mobile Application Development, John Wiley & Sons, Ref: www.it-ebooks.org
2.	Maximiliano Firtman, Programming the mobile Web, Oreilly, 2nd Edition, 2013, ISBN: 978-1-449-33497-0

Reference Books:

Sl.No.	Reference Books Digital Content
1.	Digital Content: http://en.wikibooks.org/wiki/Category: J2ME_Programming
2.	Android Studio Development Essentials, ref: http://www.techotopia.com/

Guidelines for 410452D Open Elective:
The listed open electives or any other electives that are being taught in the current semester (Term II) under engineering faculty or an individual college and Industry can define new elective with proper syllabus using defined framework of 410452D Elective IV as per following format and GET IT APPROVED FROM THE BOARD OF STUDIES COMPUTER ENGINEERING AND OTHER NECESSARY STATUTORY SYSTEMS of SAVITRIBAI PHULE PUNE UNIVERSITY BEFORE 30th DECEMBER.

410452D Elective-IV (Open Elective)

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In semester Assessment: 30
End Semester Assessment : 70

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problem of Inter-disciplinary challenges.
- To apply algorithmic skills for computing Applications.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Unit	Content	Hrs
I	**Concepts with Mathematical treatments**	
II	**Concepts**	
III	**Concepts and related algorithms**	
IV	**Concepts and related algorithms**	
V	**Advanced Tools, Techniques**	
VI	**Advanced Applications**	

Text Books:

Sl.No.	Text Books
1.	
2.	

Reference Books:

Sl.No.	Reference Books
1.	
2.	

Frame suitable assignments as per format of Computer Laboratory-IV, add necessary programming FOSS tools.

410453 Computer Laboratory-III

Teaching Scheme
Practicals: 4 Hrs/Week

Examination Scheme
Oral Assessment: 50
Practical Assessment : 50

Course Objectives:

- To develop problem solving abilities using Mathematical Modeling
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To implement software design and testing in distributed, concurrent and parallel environments

Course Outcomes:

- To solve problems using mathematical modeling.
- To use software design methods and testing.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Tools:

64-bit Fedora or equivalent OS with 64-bit Intel-i5/i7 or latest higher processor computers, FOSS tools, Ruby on Rails, iburg, XMLVM, Intel Internet of Things (IoT) Developer Kit or Intel Galileo board or BBB or Open Source equivalent, the real-time operating system (RTOS) for IoT, NS3, Scala, Python, Modelio, StarUML2.x evaluation version, HTML-5 Camel, KADOS, NoSQLUnit

Evaluation and Term-work Assessment Method: Practical, Oral and Term work Assessment Scheme guidelines are to be used for evaluation.

A. Each Assignment/Class Designed must have Mathematical modeling using relevant Divide-n-Conquer strategies to be assessed for 10% of the Marks (Paper Work/Digital Write-up);

B. In A above, an ability demonstrated for eliminating the redundant Conditional statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

C. In A above, an ability demonstrated for eliminating the redundant Loops statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

D. The functioning of the programs is to be demonstrated by Black-Box Testing for 10% of the Marks;

E. White-Box Walk through Testing methods for 10% of the marks;

F. Positive-Negative testing for 10% of the marks;

G. In addition to these testing methods, student must select one of the advanced Software Testing method currently practiced in the Industry which is suitable for the functional assignment of the Reliability for 10% of the marks.

H. 10% of the marks are to be given for the Oral Questions using above.

I. 10% of the marks are to be given for the output generated for the practical/Oral/Term work.

J. The assessment as above is to be done by a pair of examiners as per prevailing rules of SPPU examination and items A,B,E by Examiner 1 and items C,D,F by Examiner 2 and items G,H,I to be assessed Jointly;

K. Latex or its equivalent be used to generate the document to be stored in the Read-only Digital Media as a term-work/Digital Journal format approved by the BoS after checking, removing/ avoiding the plagiarism. Give an additional assignment per assignment reporting plagiarism to be submitted in the journal under the heading extra-work.

L. Examination to be conducted on the assignments performed (Group A and Group-B).

Laboratory Assignments:

- **Group A (Mandatory Six Assignments)**

1. Using Divide and Conquer Strategies and object-oriented software design technique using Modelio to design a software function for Binary Search for an un-ordered data stored in memory. Use necessary USE-CASE diagrams and justify its use with the help of mathematical modeling and related efficiency. Implement the design using Eclipse C++ or python.

2. Using Divide and Conquer Strategies to design an efficient class for Concurrent Quick Sort and the input data is stored using XML. Use object oriented software design method and Modelio/ StarUML2.x Tool. Perform the efficiency comparison with any two software design methods. Use necessary USE-CASE diagrams and justify its use with the help of mathematical modeling. Implement the design using Scala/ Python/Java/C++.

3. A Web Tool for Booth's multiplication algorithm is used to multiply two numbers located in distributed environment. Use software design client-server architecture and principles for dynamic programming. Perform Risk Analysis. Implement the design using HTML-5/Scala/ Python/Java/C++/ Rubi on Rails. Perform Positive and Negative testing. Use latest open source software modeling, Designing and testing tool/Scrum-it/KADOS and Camel.

4. In an embedded system application Dining Philosopher's problem algorithm is used to design a software that uses shared memory between neighboring processes to consume the data. The Data is generated by different Sensors/WSN system Network and stored in MOngoDB (NoSQL). Implementation be done using Scala/ Python/ C++/ Java. Design using Client-Server architecture. Perform Reliability Testing. Use latest open source software modeling, Designing and testing tool/Scrum-it/KADOS, NoSQLUnit and Camel.

5. A Mobile App for Calculator having Trigonometry functionality is to be designed and tested. The data storage uses 1.text files, 2. XML Use latest open source software modeling, Designing and testing tool/ Scrum-it. Implement the design using HTML-5/Scala/ Python/Java/C++/Rubi on Rails. Perform Positive and Negative testing.

Elective-III A. Write a mobile application to fetch all audio files and, play the audio file when user clicks on any audio file from list view. Create Mobile GUI using Python/ Scala/ Java/ HTMK5/ Android.

Elective-III B. Create a web based e-Health Application for online appointments for the medical practitioner or hospital.

Elective-III C. Install following Cloud Simulators/Tools and frame suitable assignments to demonstarte its use: CloudSim, CloudAnalyst, GreenCloud/Docker, iCanCloud/IBM Smart Cloud, GDCSim/SPECI, MDCSim/ NetworkCloudSim.

Elective-III D. Write a program in python/ Java/ Scala/ C++/ HTML5 to implement password data encryption. Use encryption method overloading (any to methods studied)

- **Group B (Any Six Assignments: atleast 3 from the selected Elective) All assignments must be covered in a students batch of laboratory.**

1. 8-Queens Matrix is Stored using JSON/XML having first Queen placed, use back-tracking to place remaining Queens to generate final 8-queen's Matrix using Python.

2. A Web application for Concurrent implementation of ODD-EVEN SORT is to be designed using Real time Object Oriented Modeling(ROOM). Give the necessary design diagrams and write the test cases for the white box testing. Draw Concurrent collaboration Diagrams.

3. A mobile application needs to be designed for using a Calculator (+, - ,*, /, Sin, Cos, sq-root) with Memory Save/Recall using Extended precision floating point number format. Give the Required modeling, Design and Positive-Negative test cases.

4. Write a web application using Scala/ Python/ Java /HTML5 to check the plagiarism in the given text paragraph written/ copied in the text box. Give software Modeling, Design, UML and Test cases for the same using COMET(Concurrent Object Oriented Modeling and Architectural Design Method).

5. Write a web application using Scala/ Python/ Java /HTML5 to check the plagiarism in the given text paragraph written/ copied in the text box. Give software Modeling, Design, UML and Test cases for the same using Analysis Modeling (Static Modeling, Object Structuring, Dynamic Modeling).

6. 8-Queens Matrix is Stored using JSON/XML having first Queen placed, use back-tracking to place remaining Queens to generate final 8-queen's Matrix. Use suitable Software modeling , Design and testing methods. Justify the selection over other methods.

Elective-III A1 Write a web application using Scala/ Python/ Java /HTML5 to check the plagiarism in the given text. The required dataset must be available to the application to the logged-in mobile device. The database is maintained in NoSQL.

Elective-III A2 Write a mobile application to fetch images from the sdcard. Also provide the facility of deleting, renaming the images.

Elective-III A3 Write a mobile application for uploading and downloading the files on server. The Server can also be from Cloud platform.

Elective-III A4 Create a Menu based application for mobile devices which can do all the activities for Human resource management like
a. Employee attendance
b. Employee notices
c. Payroll Systems

Elective-III A5 Write a mobile application for Configuring mobile as
a. HOTSPOT Device
b. Sharing files through Bluetooth
c. Messaging to other mobile for inviting to play a game
For playing TiC-TaC-ToY Game. Use J2ME/ Python/ Scala/Android for programming

Elective-III B1 Write a web application using Scala/ Python/ Java /HTML5 to check the plagiarism in the given text. The required data-set must be available to the application to the logged-in IoT device.

Elective-III B2 Concurrent implementation of ODD-EVEN SORT is to be implemented as a web application using HTML5/ Scala/ Python/ Java. Write a debugger to test the performance of White-box testing.

Elective-III B3 Create a video web chat server with text messaging option. Detect the web cam attached to devices like computer/mobile phone.

Elective-III B4 Create a simple web services for
a. Calculator (+, - ,*, /, Sin, Cos, sq-root) with Memory Save/Recall using Extended precision floating point number format,
b. Currency Converter or Unit Converters
using object oriented programming using HTML5/ Pythom/ Java/ Scala

Elective-III B5 Create a web page for online registration of the international seminar. The participants can be students, faculty members, professional, and company / firm representatives from different countries. The registration fees should be accepted either in rupees or dollar or Pounds or Euros. The payment can be made by credit card, debit card or demand draft. The participants should give choice for accommodation for provided four hotels with services (minimum five other than basic services) required.
Use object oriented programming to create the web page with required form elements and default values. The form should provide the controls for the information to accept above mentioned details as well as for personal and other relevant information. You can use JSP/ HTML5/ Scala/ Python along with Database connectivity.

Elective-III C1 Lab teacher to frame suitable assignment to demonstrate the use of following PaaS tools: Cloud Foundry (Hint: Use Spring Framework), GoogleApp Engine, OpenShift

Elective-III C2 Perform a suitable assignment using Xen Hypervisor or equivalent open source to configure it. Give necessary GUI.

Elective-III C3 Write a program to create a bucket in an installed cloud.

Elective-III C4 Execute atleast three command related to the Storage organization of the cloud; Create necessary GUI using Python.

Elective-III C5 Create a VM depending on the user requirements.

Elective-III D1 A message is to be transmitted using network resources from one machine to another calculate and demonstrate the use of a Hash value equivalent to SHA-1. Develop peogram in C++/Python/Scala/Java using Eclipse.

Elective-III D2 Write a program to generate a pseudorandom number generator for generating the long-term private key and the ephemeral keys used for each signing based on SHA-1 using Python/Java/C++. Disregard the use of existing pseudorandom number generators available.

Elective-III D3 Write a program to produce a DSA signature using parameter tuple¡p,q,g¿, long term key pair and a message digest.

Elective-III D4 Write a Python/ Java program to validate the parameter tuple for the security of the DSA. Design necessary classes. Use Miller-Rabin primality testing may be used.

Elective-III D5 Write a program in Python/ Java/ C++ /Scala using Eclipse to Start/Stop the IDS, View current traffic, View blocked list (IP, Domains), view current firewall rules and unblock users. Create Necessary GUI.

- **Group C (Any One Assignment)**

1 Installation of Open source Cloud Infrastructure

2 Install and Use Latest IDS (Open Source).

Text Books:

Sl.No.	Text Books
1.	Laboratory Manual generated by the Laboratory Teachers of the respective college, in the Term-work Format; to be assessed and approved by the BoS
2.	Content in Digital Library

410454 Computer Laboratory-IV

Teaching Scheme
Practicals : 4 Hrs/Week

Examination Scheme
Term Work Assessment: 50
Oral Assessment : 50

Course Objectives:

- To develop problem solving abilities using HPC.
- To Develop problem solving abilities using Business Analytics, OR and Mobile Programming.
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes:

- Ability to develop applications using BIA Technologies.
- Ability to develop applications using OR and Mobile Programming Technologies.
- To solve problems for multi-core or distributed, concurrent/Parallel environments

Tools:

64-bit Fedora or equivalent OS with 64-bit Intel-i5/i7 or latest higher processor computers, FOSS tools, LEX, YACC, DAG, iburg, XMLVM, Intel Internet of Things (IoT) Developer Kit or Intel Galileo board or BBB or Open Source equivalent, VxWorks® or open source equivalent, the real-time operating system (RTOS) for IoT, NS3, Scala, Python, HPC infrastructure

Evaluation and Term-work Assessment Method: Practical, Oral and Term work Assessment Scheme guidelines are to be used for evaluation.

A. Each Assignment/Class Designed must have Mathematical modeling using relevant Divide-n-Conquer strategies to be assessed for 10% of the Marks (Paper Work/Digital Write-up);

B. In A above, an ability demonstrated for eliminating the redundant Conditional statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

C. In A above, an ability demonstrated for eliminating the redundant Loops statements is to be evaluated for the 20% of the marks(Paper Work/Digital Write-up).

D. The functioning of the programs is to be demonstrated by Black-Box Testing for 10% of the Marks;

E. White-Box Walk through Testing methods for 10% of the marks;

F. Positive-Negative testing for 10% of the marks;

G. In addition to these testing methods, student must select one of the advanced Software Testing method currently practiced in the Industry which is suitable for the functional assignment of the Reliability for 10% of the marks.

H. 10% of the marks are to be given for the Oral Questions using above.

I. 10% of the marks are to be given for the output generated for the practical/Oral/Term work.

J. The assessment as above is to be done by a pair of examiners as per prevailing rules of SPPU examination and items A,B,E by Examiner 1 and items C,D,F by Examiner 2 and items G,H,I to be assessed Jointly;

K. Latex or its equivalent be used to generate the document to be stored in the Read-only Digital Media as a term-work/Digital Journal after checking, removing/ avoiding the plagiarism. Give an additional assignment per assignment reporting plagiarism to be submitted in the journal under the heading extra-work.

L. Examination to be conducted on the assignments performed (Group A and Group-B).

Laboratory Assignments:

- **Group A (Mandatory Six Assignments)**

1. Using Divide and Conquer Strategies design a cluster/Grid of BBB or Rasberi pi or Computers in network to run a function for Binary Search Tree using C /C++/ Java/Python/ Scala
2. Using Divide and Conquer Strategies design a class for Concurrent Quick Sort using C++.
3. Write a MPI program for calculating a quantity called coverage from data files.
   Hint :- Program distributes computation efficiently across the cluster. The program should be able to work with any number of nodes and should yield the same results as the serial code.
4. Write a program on an unloaded cluster for several different numbers of nodes and record the time taken in each case. Draw a graph of execution time against the number of nodes.
5. build a small compute cluster using Raspberry Pi/BBB modules to implement Booths Multiplication algorithm.

Elective-IV A. Use Business intelligence and analytics tools to recommend the combination of share purchases and sales for maximizing the profit.

Elective-IV B. A paint manufacturing company produces the interior and exterior paints using two raw materials M1 and M2. XML/JSON is used to store the following data i.e. Tons of Raw materials required to manufacture a ton of paint;

	Exterior Paints (1 Ton)	Interior Paints (1 Ton)	Maximum daily availability (tons)
Raw Material, M1	6	4	24
Raw Material, M2	1	2	6
Profit per Ton	5	4	

The market survey indicates that the daily demand for interior paint cannot exceed that for exterior paints by more than 1 ton. The maximum daily demand for interior paint is 2 tons. Write a program to recommend the optimally best products manufacturing quantity in tons of interior and exterior paints to maximize the total daily profit. Design necessary schema/ data structure and write a program using Scala/ python/ Java/ C++ to access the data to generate result using graphical method to Linear Problem(LP) and Tabular method for LP.
(Hint: Refer page 9 of the elective text book 1 (410452B).)

Elective-IV C. Write a mobile application to generate a Scientific calculator using J2ME/ Python/ Scala/ C++/ Android.

Elective-IV D. Design a suitable assignment in consultation with the industry expert for an open elective.

- **Group B (Any Six Assignments: atleast 1 from the selected Elective) All assignments must be covered in a students batch of laboratory.**

1. 8-Queens Matrix is Stored using JSON/XML having first Queen placed, use back-tracking to place remaining Queens to generate final 8-queen's Matrix using Python. Create a backtracking scenario and use HPC architecture (Preferably BBB) for computation of next placement of a queen.
2. Concurrent implementation of Tarson's Multiplication using BBB HPC or equivalent infrastructure. Use Java/ Python/ Scala/ C++ as programming language.
3. Develop a stack sampling using threads using VTune Amplifier.
4. Write a program to check task distribution using Gprof.l
5. Develop porting linux application for sorting of task essentials
6. Implement OBST Tree search using HPC task sub-division. Merge the results to get final result.
7. Perform concurrent ODD-Even Merge sort using HPC infrastructure (preferably BBB) using Python/ Scala/ Java/ C++.

8. Perform DSP(Digital Signal Processing) convolution operation on a given signal stored using XML/JSON/ text file using HPC infrastructure.

Elective-IV A1 A Mall has number of items for sale. Build a required Database to develop BAI tool for considering one aspect of growth to the business Such as organization of products based on demand and patterns use R Programming or other equivalent latest tools used in Industry or Use Hadoop, HDFS, HIVE, PIG, mongoBD Connectors for Hadoop and/OR other latest technology tools in the Hadoop Ecosystem for unstructured data analytics to effectively use advanced SQL functions and Greenplum extensions for in-database analytics. Use MADlib bigdata tools to solve analytics problems in-database Used for this assignment.

Elective-IV A2 Frame the suitable assignment to perform computing using BIA tools effectively.

Elective-IV B1 For the given data table in XML/JSON/ Simple File, Construct a two person zero-sum game using Python/Scala/C++. Design necessary data structures/schema (Hint: Refer pages 472, 473 Text Book 1 for the data).

Elective-IV B2 Design a suitable data for transportation problem or use of Poisson Distribution for Job Arrival and efficient execution and construct the OR solution. Write a program for the same.

Elective-IV C1 Write a Mobile App program using J2ME /Python /Scala /Java /Android to check the palindrome in a given string.

Elective-IV C2 Write a mobile smart App to call a emergency land-line number/ mobile number using gyroscope/ iris recognition/ thumb recognition or alike features of smart phone.

Elective-IV D1 To be defined by Industry persons supporting the open elective.

Elective-IV D2 To be defined by Industry persons supporting the open elective.

- **Group C (Any One Assignment)**

1 Write HTML5 programming techniques to compile a text PDF file integrating Latex.

2 Select an Industrial sector and write a BIA tool for maximizing the profit. [Optional: Placement Companies.]

3 Design suitable assignment for Mobile Programming [Optional: to take a snapshot using mobile camera.]

Text Books:

Sl.No.	Text Books
1.	Laboratory Manual generated by the Laboratory Teachers of the respective college, in the Term-work Format; to be assessed and approved by the BoS
2.	Content in Digital Library

410454 Project

Teaching Scheme
Tutorials: 6 Hrs/Week

Examination Scheme
Term Work Assessment: 100
Oral Assessment: 50

Course Objectives:

- To develop problem solving abilities using mathematics;
- To apply algorithmic strategies while solving problems;
- To develop time and space efficient algorithms;
- To develop software engineering documents and testing plans;
- To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments.
- To encourage and expose students for participation in National/ International paper presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities.

Course Outcomes:

- To solve problem and demonstrate the results of the project;
- To develop SRS, reliability testing reports, and other software engineering documents in the project report;
- To solve problems using multi-core, distributed, embedded, concurrent/Parallel environments;
- To write conference paper;
- To demonstrate presentation, communication and team-work skills.

Tools:

Preferably 64-bit FOSS tools but if sponsoring company's requirement is non-open source platform then it must be latest and current version of non-absolute tools. Latest SAN, 3-tier architectures along with latest version of FOSS Operating systems like Fedora 21 or equivalent, LAMP tools, WEB server, Applications servers, Database servers, MongoDB or latest open source BigDATA tools, FOSS Programming Tools like gcc,g++,Eclipse, Python, Java and other tools are per requirement of the SRS. The documentation tools like Open office, GIT, Latex, Latex-Presentation.

1. Project workstation selection, installations and setup along with report to the guide. (recommended submission date:- 3 weeks after commencement of second term)
2. Programming of the project, GUI (if any) as per 1 st Term term- work submission.(recommended submission date:- Progress report every week during laboratory)
3. Test tool selection for various testing recommended by preferably external guide and generate various testing result charts, graphs etc. including reliability testing. (7 weeks before Term II Conclusion)
4. Review of design and necessary corrective actions taking into consideration feedback report of Term I assessment, and other competitions/conferences participated like IIT, Central Universities, University Conferences or equivalent centers of excellence etc.
5. Students must submit and preferably publish atleast one technical paper in the conferences held by IITs, Central Universities or UoP Conference or International Conferences in Europe or US.

6. Final term work submissions in the prescribed format given by the guides consisting of a project report consisting of a preliminary report prepared in term-I, detailed design (all necessary UML diagrams) document, User Interface design, Laboratory assignments on test cases and test results generated by selected project testing tool, conclusions, appendix (if necessary), glossary, tools used and references at the end of Term-II **after checking, removing/ avoiding the plagiarism. Give an additional assignment per reporting plagiarism to be submitted in the report under the Annex heading extra-work. If the project is the replica of any other previous project or work from other unrelated persons than the students team, such project should be rejected for the term work.**

7. The Term II examination is conducted by panel of examiners (preferably guide and expert from Industry having atleast 5 years subject experience (or senior teacher in the subject in case of non- availability of industry expert). The project assessment shall be done using Live Project Demonstration [in existing functional condition], using necessary simulators (if required) and presentation by the students. The remarks of Term I assessment and related corrective actions must be assessed during examining the term-work.

Term-II Project Laboratory Assignments:

1. Review of design and necessary corrective actions taking into consideration the feedback report of Term I assessment, and other competitions/conferences participated like IIT, Central Universities, University Conferences or equivalent centers of excellence etc.

2. Project workstation selection, installations along with setup and installation report preparations.

3. Programming of the project functions, interfaces and GUI (if any) as per 1 st Term term-work submission using corrective actions recommended in Term-I assessment of Term-work.

4. Test tool selection and testing of various test cases for the project performed and generate various testing result charts, graphs etc. including reliability testing.
   Additional assignments for the Entrepreneurship Project:

5. Installations and Reliability Testing Reports at the client end.

6. To study Clients Feedback reports and related fix generations.

7. To create Documents Profit and Loss accounts and balance-sheet of the company.

Note: If the students fails to complete the Entrepreneurship assignment successfully then the project shall be treated as Internal Project for the purpose of assessment.

Reference Books:

Sl.No.	Reference Books
1.	Term-I Project Report with Corrections, plagiarism reports, project replica reports
2.	Journals references necessary for the Project