FRANCIS XAVIER ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION

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CURRICULUM AND SYLLABI
Choice Based Credit System
Regulations 2019

M.E – Computer Science and Engineering

Department Vision

"To become a center of excellence in Computer Science and Engineering and Research to create global leaders with holistic growth and ethical values for the industry and academics"

Department Mission

- To produce technocrats in the industry and academia by educating computer concepts and techniques.
- To facilitate the students to trigger more creativity by applying modern tools and technologies in the field of computer science and engineering
- To inculcate the spirit of ethical values contributing to the welfare of the society.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

TABLE OF CONTENTS

S.NO.	CONTENT	PAGE NO.
1	PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	3
2	PROGRAM OUTCOMES (POs)	3
3	PROGRAMME SPECIFIC OUTCOMES (PSOs)	4
4	MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES	5
5	MAPPING OF PROGRAMME SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES	5
6	SUMMARY OF CREDIT DISTRIBUTION	6
7	I – IV SEMESTERS CURRICULUM AND SYLLABI	7
8	PROFESSIONAL ELECTIVES	9
12	EMPLOYABILITY ENHANCING COURSES, FOUNDATION COURSES, PROFESSIONAL CORE	10
13	FIRST SEMESTER SYLLABUS	12
14	SECOND SEMESTER SYLLABUS	23
15	THIRD SEMESTER SYLLABUS	53

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 **Engineering basics:** To communicate deep knowledge on basic sciences and applications of basic sciences in engineering.

PEO 2 **Career Development:** To assimilate the knowledge on basic sciences and engineering concepts to address industrial, social and environmental issues and to innovate technologies for betterment.

PEO 3 **Leadership responsibilities:** To develop interpersonal skills to strengthen team work, leadership quality and to promote awareness about continual learning not limited to higher studies.

PEO 4 **Professional qualification:** To boost professionalism in problem solving through moral and professional ethics shouldering social task.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to

assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1 **Basic Engineering :** To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering

PSO 2 **Software Development :** To apply software engineering principles and practices for developing quality software for scientific and business applications.

PSO 3 **Emerging Technologies :** To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	PROGRAMME OUTCOMES (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PEO 1	3	3	3	3	2	3					2	2
PEO 2	3			3			3					3
PEO 3						2	1		3		2	
PEO 4						3		3				

1→Low 2→Medium 3→High

MAPPING OF PROGRAMME SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Outcomes and the Programme outcomes is given in the following Table

PROGRAMME SPECIFIC OUTCOMES(PSO)	PROGRAMME OUTCOMES (PO)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PSO 1	3		3					3				
PSO 2		3	3		2	1	2			2	3	
PSO 3					3					1		2

1→Low 2→Medium 3→High

M.E COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEM

SUMMARY OF CREDIT DISTRIBUTION

S. No	CATEGORY	CREDITS PER SEMESTER									TOTAL CREDIT	CREDITS IN %	Range Of Total Credits	
		I	II	III	IV								Min	Max
1	FC	4									**4**	5.714%	5%	10%
2	PC	18	14								**32**	45.714%	15%	20%
3	PE		6	9							**15**	21.429%	15%	20%
4	EEC		1	6	12						**19**	27.143%	5%	10%
TOTAL		**22**	**21**	**15**	**12**						**70**	100%	-	-

FC - Foundation Courses

PC - Professional Core

PE - Professional Elective

EEC - Employability Enhancement Course

M.E COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEM

I – IV SEMESTERS CURRICULUM AND SYLLABI

FIRST SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19MA1251	Mathematical Foundation for Computer Science	FC	4	0	0	4	4
19CP1601	Advanced Data Structures and Algorithms	PC	4	0	0	4	4
19CP1602	Advanced Computer Architecture	PC	3	0	0	3	3
19CP1603	Advanced Operating Systems	PC	3	0	0	3	3
19CP1604	Machine Learning Techniques	PC	3	0	0	3	3
19CP1605	Advanced Software Engineering	PC	3	0	0	3	3
19CP1611	Data Structures Laboratory		0	0	4	2	4
		TOTAL	**20**	**0**	**4**	**22**	**24**

SECOND SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19CP2601	Network Design and Technologies	PC	3	0	0	3	3
19CP2602	Cyber Security	PC	3	0	0	3	3
19CP2603	Internet of Things	PC	3	0	0	3	3
19CP2604	Cloud Computing and Big Data	PC	3	0	0	3	3
	Professional Elective –I	PC	3	0	0	3	3
	Professional Elective –II	PC	3	0	0	3	3
19CP2611	Data Analytics Laboratory	PC	0	0	4	2	2
19CP2912	Term Paper Writing and Seminar	EEC	0	0	2	1	1
		TOTAL	**18**	**0**	**6**	**21**	**24**

THIRD SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
	Professional Elective –III	PE	3	0	0	3	3
	Professional Elective –IV	PE	3	0	0	3	3
	Professional Elective –V	PE	3	0	0	3	3
19CP3911	Project Phase – I	EEC	0	0	12	6	12
		TOTAL	**9**	**0**	**12**	**15**	**21**

FOURTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19CP4911	Project Work Phase – II	EEC	0	0	24	12	24
		TOTAL	**0**	**0**	**24**	**12**	**24**

L Lecture

T Tutorial

P Practical

H Hours

Code No.	Course	L	T	P	C
PROFESSIONAL ELECTIVES					
PROFESSIONAL ELECTIVE I					
19CP2701	Advanced Databases	3	0	0	3
19CP2702	Image and Video Processing	3	0	0	3
19CP2703	Security Practices	3	0	0	3
19CP2704	Web Engineering	3	0	0	3
PROFESSIONAL ELECTIVE II					
19CP2705	Real Time Systems	3	0	0	3
19CP2706	Mobile and Pervasive Computing	3	0	0	3
19CP2707	Parallel Programming Paradigms	3	0	0	3
19CP2708	Information Retrieval Techniques	3	0	0	3
19CP2709	Software Architectures and Design	3	0	0	3
PROFESSIONAL ELECTIVE III					
19CP3701	Performance Analysis of Computer Systems	3	0	0	3
19CP3702	Language Technologies	3	0	0	3
19CP3703	Computer Vision	3	0	0	3
19CP3704	Speech Processing and Synthesis	3	0	0	3
19CP3705	Software Quality Assurance and Testing	3	0	0	3
PROFESSIONAL ELECTIVE IV					
19CP3706	Formal models of software systems	3	0	0	3

Code No.	Course	L	T	P	C
19CP3707	Embedded Software Development	3	0	0	3
19CP3708	Social Network Analysis	3	0	0	3
19CP3709	Compiler Optimization Techniques	3	0	0	3
19CP3710	Bio-Inspired Computing	3	0	0	3
PROFESSIONAL ELECTIVE V					
19CP3711	Data Visualization Techniques	3	0	0	3
19CP3712	Reconfigurable Computing	3	0	0	3
19CP3713	Mobile Application Development	3	0	0	3
19CP3714	Bio Informatics	3	0	0	3
19CP3715	Information Storage Management	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSE (EEC)					
19CP2912	Term Paper Writing and Seminar	0	0	2	1
19CP3911	Project Phase – I	0	0	12	6
19CP4911	Project Work Phase – II	0	0	24	12
FOUNDATION COURSES (FC)					
19MA1251	Mathematical Foundation for Computer Science	4	0	0	4
PROFESSIONAL CORE (PC)					
19CP1601	Advanced Data Structures and Algorithms	4	0	0	4
19CP1602	Advanced Computer Architecture	3	0	0	3
19CP1603	Advanced Operating System	3	0	0	3
19CP1604	Machine Learning Techniques	3	0	0	3

Code No.	Course	L	T	P	C
19CP1605	Advanced Software Engineering	3	0	0	3
19CP1611	Data Structures Laboratory	0	0	4	2
19CP2601	Network Design and Technologies	3	0	0	3
19CP2602	Cyber Security	3	0	0	3
19CP2603	Internet of Things	3	0	0	3
19CP2604	Cloud Computing and Big Data	3	0	0	3
19CP2611	Data Analytics Laboratory	0	0	4	2

19MA1251 MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

L	T	P	C
4	0	0	4

OBJECTIVES:

1. Provide the solid foundation on topics in applied probability and various statistical methods
2. Knowledge in many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling.
3. Address the issues and the principles of estimation theory
4. Testing of hypothesis and multivariate analysis

PRE-REQUISITE:

- Probability

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye‘s theorem - Random variables Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT III ESTIMATION THEORY 12

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Small and large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables.

Total: 60 Periods

REFERENCE BOOK(S):

1. Dallas E. Johnson, ―Applied Multivariate Methods for Data Analysis‖, Thomson and Duxbury press, 1998.

2. Gupta S.C. and Kapoor V.K.,‖ Fundamentals of Mathematical Statistics‖, Sultan and Sons, New Delhi, 2001.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.
4. Richard A. Johnson and Dean W. Wichern, ―Applied Multivariate Statistical Analysis‖, 5th Edition, Pearson Education, Asia, 2002.
5. Devore, J. L., ―Probability and Statistics for Engineering and the Sciences‖, 8th Edition, Cengage Learning, 2014.

COURSE OUTCOME(S):

CO101. 1 Basic probability axioms and rules and the moments of discrete and continuous random variables.

CO101. 2 Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.

CO101. 3 Use statistical tests in testing hypotheses on data.

CO101. 4 Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

CO101. 5 Ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO101.	3	2										1
CO101.	3	2										1
CO101.	3	3		2	1	1			1			1
CO101.	3	3		2	1	1			1			1
CO101.	3	3			1	1						1

1→Low 2→Medium 3→High

19CP1601 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
4 0 0 4

OBJECTIVES:

1. To understand the usage of algorithms in computing.
2. To learn and use hierarchical data structures and its operations
3. To learn the usage of graphs and its applications.
4. To select and design data structures and algorithms that is appropriate for problems.
5. To study about NP Completeness of problems.

PRE-REQUISITE:

- Data Structures

UNIT I ROLE OF ALGORITHMS IN COMPUTING 12

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method.

UNIT II HIERARCHICAL DATA STRUCTURES 12

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B- trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

UNIT III GRAPHS 12

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – ToPO12ogical Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd- Warshall Algorithm.

UNIT IV ALGORITHM DESIGN TECHNIQUES 12

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes.

UNIT V NP COMPLETE AND NP HARD 12

NP-Completeness: PO12ynomial Time – PO12ynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems.

Total: 60 Periods

REFERENCE BOOK(S):

1. Robert Sedgewick and Kevin Wayne, ―ALGORITHMS‖, Fourth Edition, Pearson Education.
2. S.Sridhar,‖Design and Analysis of Algorithms‖, First Edition, Oxford University Press. 2014
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, ―Introduction to Algorithms‖, Third Edition, Prentice-Hall, 2011.
4. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.

COURSE OUTCOME(S):

CO102. 1 Design data structures and algorithms to solve computing problems

CO102. 2 Design algorithms using graph structure to solve real-life problems.

CO102. 3 Design algorithms using various string matching algorithms to solve real-life problems.

CO102. 4 Apply suitable design strategy for problem solving.

CO102. 5 Understand NP Complete and NP Hard Problems.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO102.	3		2	3	1	1						1
CO102.	3		2	3	1	1					2	1
CO102.	3		2	3	1	1					2	1
CO102.	3	2	2	3	1	1						1
CO102.	3		2	3	1	1						1

1→Low 2→Medium 3→High

19CP1602 ADVANCED COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

1. To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
2. To learn the different multiprocessor issues.
3. To expose the different types of multicore architectures.
4. To understand the design of the memory hierarchy.

PRE-REQUISITE:

- Computer Organization and Architecture

UNIT I FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading.

UNIT II MEMORY HIERARCHY DESIGN 9

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III MULTIPROCESSOR ISSUES 9

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study- Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers- Architectures- Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer.

UNIT V VECTOR, SIMD AND GPU ARCHITECTURES 9

Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies.

Total: 45 Periods

REFERENCE BOOK(S):

1. Darryl Gove, ―Multicore Application Programming: For Windows, Linux, and Oracle Solaris‖, Pearson, 2011
2. David B. Kirk, Wen-mei W. Hwu, ―Programming Massively Parallel Processors‖, Morgan Kauffman, 2010
3. David E. Culler, Jaswinder Pal Singh, ―Parallel computing architecture : A hardware/software approach‖ , Morgan Kaufmann /Elsevier Publishers, 1999

COURSE OUTCOME(S):

CO103. 1 Identify the limitations of ILP

CO103. 2 Discuss the issues related to multiprocessing and suggest solutions.

CO103. 3 Point out the salient features of different multicore architectures and how they exploit parallelism.

CO103. 4 Discuss the various techniques used for optimising the cache performance.

CO103. 5 Design hierarchal memory system.

CO103. 6 Point out how data level parallelism is exploited in architectures.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO103.	3			2							1	2
CO103.	3	2	2	2		1					1	2
CO103.	3	2	2	2							1	2
CO103.	3	2	2	3	1						1	2

CO103.	3	3	3	3	1						1	2
CO103.	3			3	1						1	2

1→Low 2→Medium 3→High

19CP1603 ADVANCED OPERATING SYSTEM L T P C
3 0 0 3

OBJECTIVES:

1. To be able to read and understand sample open source programs and header files.
2. To learn how the processes are implemented in linux.
3. To understand the implementation of the Linux file system.
4. To study Linux memory management data structures and algorithms.
5. To acquire the knowledge in the implementation of interprocess communication.
6. To understand how program execution happens in Linux.

PRE-REQUISITE:

- Operating System

UNIT I INTRODUCTION 9

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types - Inodes - Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - Process Management Memory Management - Device Drivers.

UNIT II PROCESSES 9

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes -Termination - Removal.

UNIT III FILE SYSTEM 9

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Filesystems - Filesytem Type Registration - Filesytem Handling - Namespaces – Mounting Unmounting - Implementation of VFS System Calls.

UNIT IV MEMORY MANAGEMENT 9

Page frame management -page descriptors - non-uniform memory access - memory zones - reserved page frames - zoned page frame allocator - kernel mappings - buddy system algorithm - page frame cache - zone allocator.

UNIT V PROCESS COMMUNICATION AND PROGRAM EXECUTION 9

Process Communication - Pipes -Usage - Data Structures - Creating and Destroying a Pipe - Reading From and Writing into a Pipe. Program Execution - Executable Files - Process Credentials - Command-Line Arguments and Shell Environment - Libraries - Program Segments and Process Memory Regions - Execution tracing - Executable Formats - Execution Domains - The exec Functions.

Total: 45 Periods

REFERENCE BOOK(S):

1. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O'Reilly Publications, 2005.
2. Harold Abelson, Gerald Jay Sussman and Julie Sussman, ―Structure and Interpretation of Computer Programs‖, Second Edition, Universities Press, 2013.
3. Maurice J. Bach, ―The Design of the Unix Operating System‖ 1st Edition Pearson Education, 2003.
4. Michael Beck, Harald Bohme, Mirko Dziadzka, Ulrich Kunitz, Robert Magnus, Dirk Verworner, ―Linux Kernel Internals‖, 2nd Edition, Addison-Wesley, 1998.
5. Robert Love, ―Linux Kernel Development‖, 3rd Edition, Addison-Wesley, 2010

COURSE OUTCOME(S):

CO104. 1 To explain the functionality of a large software system by reading its source.

CO104. 2 To revise any algorithm present in a system.

CO104. 3 To design a new algorithm to replace an existing one.

CO104. 4 To use appropriate algorithm for memory management.

CO104. 5 To appropriately modify and use the data structures of the linux kernel for a different software system.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO104.	3	2	2	2	2						1	1
CO104.	3	3	3	3	3						1	1
CO104.	3	3	3	3	3	1					1	1
CO104.	3	3	3	3	3						1	1
CO104.	3	3	3	3	3						1	1

1→Low 2→Medium 3→High

19CP1604 MACHINE LEARNING TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
3. To study the various probability based learning techniques
4. To understand graphical models of machine learning algorithms

PRE-REQUISITE:

- Artificial Intelligence

UNIT I INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – InterPO12ations and Basis Functions – Support Vector Machines.

UNIT III TREE AND PROBABILISTIC MODELS 9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS 9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

UNIT V GRAPHICAL MODELS 9

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

Total: 45 Periods

REFERENCE BOOK(S):

1. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
4. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
5. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013

COURSE OUTCOME(S):

CO105. 1 Distinguish between, supervised, unsupervised and semi-supervised learning

CO105. 2 Apply the appropriate machine learning strategy for any given problem

CO105. 3 Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.

CO105. 4 Design systems that uses the appropriate graph models of machine learning

CO105. 5 Modify existing machine learning algorithms to improve classification efficiency.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO105.	3										1	2
CO105.	2	3	3	3							1	2
CO105.	2	3	2	3							1	2
CO105.	3	2	3	3	2	1					1	2
CO105.	2	3	3	3							1	2

1→Low 2→Medium 3→High

19CP1605 ADVANCED SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand Software Engineering Lifecycle Models
2. To do project management and cost estimation

3. To gain knowledge of the System Analysis and Design concepts.
4. To understand software testing approaches
5. To be familiar with DevOps practices

PRE-REQUISITE:

- Software Engineering

UNIT I INTRODUCTION 9

Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management Project planning – Estimation – Scheduling – Risk management – Software configuration management.

UNIT II SOFTWARE REQUIREMENT SPECIFICATION 9

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram.

UNIT III ARCHITECTURE AND DESIGN 9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client- server - Tiered - Pipe and filter.- User interface design.

UNIT IV TESTING 9

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking.

UNIT V DEVOPS 9

DevOps:Motivation-Cloud as a platform-Operations- Deployment Pipeline:Overall Architecture-Building and Testing-Deployment- Case study: Migrating to Microservices.

Total: 45 Periods

REFERENCE BOOK(S):

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearso Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

4. Len Bass, Ingo Weber and Liming Zhu, ―DevOps: A Software Architect‘s Perspective‖, Pearson Education, 2016
5. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
6. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.

COURSE OUTCOME(S):

CO106. 1 Understand the advantages of various Software Development Lifecycle Models

CO106. 2 Gain knowledge on project management approaches as well as cost and schedule estimation strategies

CO106. 3 Perform formal analysis on specifications,Use UML diagrams for analysis and design

CO106. 4 Architect and design using architectural styles and design patterns

CO106. 5 Understand software testing approaches and the advantages of DevOps practices

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO106.	3		3	3	3	3	3					
CO106.	3		1	3	3	2	3					
CO106.	3		3	2	3	3	3					
CO106.	3		3	3	3	3	2					
CO106.	3		3	2	3	3	3					

1→Low 2→Medium 3→High

19CP1611 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

1. To acquire the knowledge of using advanced tree structures.
2. To learn the usage of heap structures.
3. To understand the usage of graph structures and spanning trees

PRE-REQUISITE:

- Data Structures

LIST OF EXPERIMENTS:

Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous four-hour session per week or two two-hour sessions per week. There will be about 15 exercises in a semester. It is recommended that all implementations are carried out in Java. If C or C++

has to be used, then the threads library will be required for concurrency. Exercises should be designed to cover the following topics:

1. Implementation of Merge Sort and Quick Sort-Analysis
2. Implementation of a Binary Search Tree
3. Red-Black Tree Implementation
4. Heap Implementation
5. Fibonacci Heap Implementation
6. Graph Traversals
7. Spanning Tree Implementation
8. Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm)
9. Implementation of Matrix Chain Multiplication
10. Activity Selection and Huffman Coding Implementation.

Total: 60 Periods

COURSE OUTCOME(S):

CO107. 1 Design and implement basic and advanced data structures extensively.

CO107. 2 Design algorithms using graph structures

CO107. 3 Design and develop efficient algorithms with minimum complexity using design techniques

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO107.	3	2	3		3							1
CO107.	3	2	3		3							1
CO107.	3	2	3		3							1

1→Low 2→Medium 3→High

19CP2601 NETWORK DESIGN AND TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the principles required for network design
2. To explore various technologies in the wireless domain
3. To study about 3G and 4G cellular networks
4. To understand the paradigm of Software defined networks

PRE-REQUISITE:

- Computer Networks

UNIT I NETWORK DESIGN 9

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Switched networks – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios – Applications, Quality of Service – End to end level and network level solutions. LAN cabling toPO12ogies – Ethernet Switches, Routers, Firewalls and L3 switches – Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP – Core networks, and distribution networks.

UNIT II WIRELESS NETWORKS 9

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security

– IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles.

UNIT III CELLULAR NETWORKS 9

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN – Core and Radio Network Mobility Management – UMTS Security.

UNIT IV 4G NETWORKS 9

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) - 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G.

UNIT V SOFTWARE DEFINED NETWORKS 9

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types

– Virtualization – Data Plane – I/O – Design of SDN Framework.

Total: 45 Periods

REFERENCE BOOK(S):

1. Erik Dahlman, Stefan Parkvall, Johan Skold, ―4G: LTE/LTE-Advanced for Mobile Broadband‖, Academic Press, 2013.
2. Jonathan Rodriguez, ―Fundamentals of 5G Mobile Networks‖, Wiley, 2015.
3. Larry Peterson and Bruce Davie, ―Computer Networks: A Systems Approach‖, 5th edition, Morgan Kauffman, 2011
4. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.
5. Martin Sauter, ―Beyond 3G - Bringing Networks, Terminals and the Web Together: LTE, WiMAX, IMS, 4G Devices and the Mobile Web 2.0‖, Wiley, 2009.
6. Naveen Chilamkurti, Sherali Zeadally, Hakima Chaouchi, ―Next-Generation Wireless Technologies‖, Springer, 2013.
7. Paul Goransson, Chuck Black, ―Software Defined Networks: A Comprehensive Approach‖, Morgan Kauffman, 2014.
8. Savo G Glisic, ―Advanced Wireless Networks – 4G Technologies‖, John Wiley & Sons, 2007.

COURSE OUTCOME(S):

CO201. 1 Identify the components required for designing a network

CO201. 2 Design a network at a high-level using different networking technologies

CO201. 3 Analyze the various protocols of wireless and cellular networks

CO201. 4 Discuss the features of 4G and 5G networks

CO201. 5 Experiment with software defined networks

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO201.	3											2
CO201.	3	3	3		3							2
CO201.	3			2								2
CO201.	3											2
CO201.	3			2								2

1→Low 2→Medium 3→High

19CP2602 CYBER SECURITY L T P C
3 0 0 3

OBJECTIVES:

1. To introduce the basic concepts and challenges in cyber security
2. To illustrate the use of modern tools to resolve the security issues
3. To implement the cyber security principles and methods in organization.

PRE-REQUISITE:

- Network Security

UNIT I INTRODUCTION TO CYBERCRIME 9

Cybercrime definition and origins of the world cybercrime and information security Classifications of cybercrime- Cybercrime and the Indian ITA 2000 - A Global Perspective on cybercrimes- Cloud Computing-Proliferation of Mobile and Wireless Devices- Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era.

UNIT II CYBER SECURITY CHALLENGES IN MODERN DEVICES 9

Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices Authentication Service Security- Attacks on Mobile/Cell Phones, Mobile Devices Security Implications for Organizations- Organizational Measures for Handling Mobile Devices Related Security Issues, Organizational Security policy and Measures in Mobile Computing Era and Laptops.

UNIT III TOOLS AND METHODS 9

Tools and Methods Used in Cyber line Proxy Servers and Anonymizers- Phishing -Password Cracking, Key loggers and Spywares, - Virus and Worms, Steganography – DoSDDoS Attacks - SQL Injection, Buffer Over Flow - Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) - The Legal Perspectives - Cyberlaw: The Indian Context - The Indian IT Act.

UNIT IV CYBER FORENSICS 9

Understanding Computer Forensics - Historical Background of Cyber forensics - Digital Forensics Science - The Need for Computer Forensics -Cyber forensics and Digital Evidence - Forensics Analysis of Email - Digital Forensics Lifecycle - Chain of Custody Concept – Network Forensics - Approaching a Computer Forensics Investigation - Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography.

UNIT V ORGANIZATIONS IMPLICATIONS 9

Organizational Implications Cost of Cybercrimes and IPR Issues: - Lesson for Organizations Web Treats for Organizations: The Evils and Perils - Security and Privacy Implications from Cloud Computing - Social Media Marketing: Security Risk and Perils for Organization – Social Computing and the Associated Challenges for Organizations - Protecting People- Privacy in the Organization, Organizational Guidelines for Internet Usage - Safe Computing Guidelines and Computer Usage policy.

Total: 45 Periods

REFERENCE BOOK(S):

1. Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi 2012.
2. Harish Chander, cyber laws & IT protection, PHI learning pvt.ltd, 2012.
3. Dhiren R Patel, Information security theory &practice,PHI learning pvt ltd,2010
4. MS.M.K.Geetha&Ms.SwapneRaman Cyber Crimes and Fraud Management, MACMILLAN,2012.

5. Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
6. VivekSood, Cyber Law Simplified, TMH, 2012.

COURSE OUTCOME(S):

CO202. 1 Implement and Manage the security essentials in IT Sector

CO202. 2 Able to explain the concepts of Cyber Security and encryption Concepts

CO202. 3 Able to attain a thorough knowledge in the area of Privacy and Storage security and related Issues

CO202. 4 Able to protect them and ultimately society from attacks

CO202. 5 Understand Safe Computing Guidelines and Computer Usage PO12icy

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202.	3	3	3	3	2						1	2
CO202.	3	2	2	2							1	2
CO202.	3	3	3	3							1	2
CO202.	3	3	3	3							1	2
CO202.	3	3	3	3							1	2

1→Low 2→Medium 3→High

19CP2603 INTERNET OF THINGS L T P C
3 0 0 3

OBJECTIVES:

1. To understand the fundamentals of Internet of Things
2. To learn about the basics of IOT protocols
3. To build a small low cost embedded system using Raspberry Pi.
4. To apply the concept of Internet of Things in the real world scenario.

PRE-REQUISITE:

- Networks

UNIT I INTRODUCTION TO IoT 9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II IoT ARCHITECTURE 9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT III IoT PROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security.

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO 9

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & EndPoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS 9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs – Cloud for IoT - Amazon Web Services for IoT.

Total: 45 Periods

REFERENCE BOOK(S):

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012.

COURSE OUTCOME(S):

CO203. 1 Analyze various protocols for IoT

CO203. 2 Develop web services to access/control IoT devices.

CO203. 3 Design a portable IoT using Rasperry Pi

CO203. 4 Deploy an IoT application and connect to the cloud.

CO203. 5 Analyze applications of IoT in real time scenario

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO203.	3	2		2		1					1	2
CO203.	3		3			1					1	2
CO203.	3				3	1					1	2
CO203.	3	2		2	2	1					1	2
CO203.	3					1					1	2

1→Low 2→Medium 3→High

19CP2604 CLOUD COMPUTING AND BIG DATA L T P C
3 0 0 3

OBJECTIVES:

1. To understand the various issues in cloud computing
2. To be able to set up a private cloud
3. To understand the competitive advantages of big data analytics
4. To understand the big data frameworks
5. To learn data analysis methods
6. To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

PRE-REQUISITE:

- Grid Computing

UNIT I CLOUD PLATFORM ARCHITECTURE 9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery – Architectural Design Challenges - Public Cloud Platforms : GAE,AWS – Inter-cloud Resource Management.

UNIT II PROGRAMMING MODEL 9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

UNIT III INTRODUCTION TO BIG DATA 9

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

UNIT IV DATA ANALYSIS 9

Statistical Methods:Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

UNIT V BIG DATA FRAMEWORKS 9

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries.

Total: 45 Periods

REFERENCE BOOK(S):

1. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
2. Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 2009.
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
5. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
6. Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
7. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
8. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
9. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
10. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O‘Reilly Media, 2013.

COURSE OUTCOME(S):

CO204. 1 Identify the architecture, infrastructure and delivery models of cloud computing

CO204. 2 Develop services using Cloud computing.

CO204. 3 Understand how to leverage the insights from big data analytics

CO204. 4 Analyze data by utilizing various statistical and data mining approaches.

CO204. 5 Understand the various NoSql alternative database models

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO204.	3										1	2
CO204.	3		2								1	2
CO204.	3										1	2
CO204.	3	3		2							1	2
CO204.	3			2	3						1	2

1→Low 2→Medium 3→High

19CP2611 DATA ANALYTICS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

1. To implement Map Reduce programs for processing big data
2. To realize storage of big data using H base, Mongo DB
3. To analyse big data using linear models
4. To analyse big data using machine learning techniques such as SVM / Decision tree classification and clustering

PRE-REQUISITE:

- Big Data

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset
4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop/R

Total: 60 Periods

LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:

Hadoop, YARN, R Package, Hbase, MongoDB.

References:

1. Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, -An Introduction to Statistical Learning with Applications in R‖, Springer Publications, 2015(Corrected 6th Printing)
3. Hadley Wickham,‖ggplot2 – Elegant Graphics for Data Analysis‖, Springer Publications,2nd Edition, 2016
4. Kristina Chodorow, "MongoDB: The Definitive Guide – Powerful and Scalable Data Storage", O'Reilley, 2nd Edition, 2013
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.
6. Tom White, ―Hadoop: The Definitive Guide – Storage and Analysis at Internet Scale‖, O'Reilley, 4th Edition, 2015

COURSE OUTCOME(S):

CO207. 1 Process big data using Hadoop framework

CO207. 2 Build and apply linear and logistic regression models

CO207. 3 Perform data analysis with machine learning methods

CO207. 4 Perform graphical data analysis

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO207.	3				2						2	2
CO207.	3		2								2	2
CO207.	3	3									2	2
CO207.	3	3		3	2						2	2

1→Low 2→Medium 3→High

19CP2912 TERM PAPER WRITING AND SEMINAR L T P C
0 0 2 1

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic

2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained. Activities to be carried out.

Activity	**Instructions**	**Submission week**	**Evaluation**
Selection of area of interest and Topic Stating an Objective	You are requested to select an area of interest, topic and state an objective	2nd week	**3 %** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about your area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries	4th week	**6%** (the list of standard papers and reason for selection)

	and Google Scholar • When picking papers to read - try to: • Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour -first‖ or -foundational‖ papers in the field (as indicated in other people's survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered		
Reading and notes for first 5 papers	Reading Paper Process • For each paper • What is the main topic of the article? • What was/were the main issue(s) the author said they want to	5th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	discuss? • Why did the author claim it was important? • How does the work build on other‘s work, in the author‘s opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)		
Reading and notes for next5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on

			your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	**10%** (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12th week	**5%** (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th & 15th week	**10%** (based on presentation and Viva-voce)

Total: 30 Periods

19CP2701 ADVANCED DATABASES

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the design of databases.
2. To acquire knowledge on parallel and distributed databases and its applications.
3. To study the usage and applications of Object Oriented and Intelligent databases.
4. To understand the emerging databases like Mobile, XML, Cloud and Big Data

PRE-REQUISITE:

- Database Management Systems

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

UNIT II INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases-Recursive Queries in SQL- Spatial Databases- Spatial Data Types - Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT III XML DATABASES 9

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

UNIT IV MOBILE DATABASES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols.

UNIT V MULTIMEDIA DATABASES 9

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

Total: 45 Periods

REFERENCE BOOK(S):

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ―Advanced Database Systems‖, Morgan Kaufmann publishers,2006
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, McGraw Hill, 2011
4. R. Elmasri, S.B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson Education/Addison Wesley, 2010.
5. Vijay Kumar, ―Mobile Database Systems‖, John Wiley & Sons, 2006.

COURSE OUTCOME(S):

CO201-1. 1 To develop skills on databases to optimize their performance in practice.

CO201-1. 2 To analyze each type of databases and its necessity.

CO201-1. 3 To design faster algorithms in solving practical database problems

CO201-1. 4 To understand the database connectivity.

CO201-1. 5 To analyze the emerging databases like Mobile, XML, Cloud and Big Data

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO201-	3		2	2							1	2
CO201-	3	3									1	2
CO201-	3		3	2							1	2
CO201-	3	2		2							1	2
CO201-	3	3									1	2

1→Low 2→Medium 3→High

19CP2702 IMAGE AND VIDEO PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the image processing concepts and analysis
2. To understand the image processing techniques
3. To familiarize the image processing environment and their applications,
4. To appreciate the use of image processing in various applications
5. To understand the video processing concepts

PRE-REQUISITE:

- Digital Image Processing

UNIT I IMAGE PROCESSING FUNDAMENTALS 9

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

UNIT II IMAGE ENHANCEMENT AND RESTORATION 9

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND MORPHOLOGY 9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- pixel based, edge based, region based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

UNIT V BASIC STEPS OF VIDEO PROCESSING 9

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

Total: 45 Periods

REFERENCE BOOK(S):

1. Alasdair McAndrew, ―Introduction to Digital Image Processing with Matlab‖, Cengage Learning 2011,India.
2. Anil J Jain, ―Fundamentals of Digital Image Processing‖, PHI, 2006.
3. Yao wang, Joem Ostarmann and Ya – quin Zhang, ”Video processing and communication “,1st edition , PHI.
4. Kavyan Najarian and Robert Splerstor,‖ Biomedical signals and Image processing‖,CRC – Taylor and Francis, New York, 2006
5. Rafael C.Gonzalez and Richard E.Woods, ―Digital Image Processing‖, Third Edition, Pearson Education, 2008, New Delhi.
6. S.Sridhar, ―Digital Image Processing‖, Oxford University Press, 2011.

COURSE OUTCOME(S):

CO201-2. 1 Design and implement algorithms for image processing applications that incorporates different concepts of medical Image Processing

CO201-2. 2 Familiar with the use of MATLAB and its equivalent open source tools.

CO201-2. 3 Critically analyze different approaches to image processing applications

CO201-2. 4 Explore the possibility of applying Image processing concepts in various applications

CO201-2. 5 Critically analyze different approaches to video processing applications

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO201-	3		3								1	2
CO201-	3				2						1	2
CO201-	3	2									1	2
CO201-	3			2							1	2
CO201-	3	2									1	2

1→Low 2→Medium 3→High

19CP2703 SECURITY PRACTICES L T P C
3 0 0 3

OBJECTIVES:

1. To learn the core fundamentals of system and web security concepts
2. To have through understanding in the security concepts related to networks
3. To deploy the security essentials in IT Sector
4. To be exposed to the concepts of Cyber Security and encryption Concepts
5. To perform a detailed study of Privacy and Storage security and related Issues.

PRE-REQUISITE:

- Cryptography and Network Security

UNIT I SYSTEM SECURITY 9

Building a secure organization- A Cryptography primer- detecting system Intrusion- Preventing system Intrusion- Fault tolerance and Resilience in cloud computing environments- Security web applications, services and servers.

UNIT II NETWORK SECURITY 9

Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network

Security - Wireless Sensor Network Security- Cellular Network Security- Optical Network Security- Optical wireless Security.

UNIT III SECURITY MANEGEMENT 9

Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System - Intrusion and Detection and Prevention System.

UNIT IV CYBER SECURITY AND CRYPTOGRAPHY 9

Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption - Password based authenticated Key establishment Protocols.

UNIT V PRIVACY AND STORAGE SECURITY 9

Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security Policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

Total: 45 Periods

REFERENCE BOOK(S):

1. John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.
2. Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.
3. Richard E.Smith, Elementary Information Security, Second Edition, Jones and Bartlett Learning, 2016

COURSE OUTCOME(S):

CO201-3. 1 Understand the core fundamentals of system security

CO201-3. 2 Apply the security concepts related to networks in wired and wireless scenario.

CO201-3. 3 Implement and Manage the security essentials in IT Sector

CO201-3. 4 Able to explain the concepts of Cyber Security and encryption Concepts

CO201-3. 5 Able to attain a through knowledge in the area of Privacy and Storage security and related Issues.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO201-	3	2	2					3				
CO201-	3					2	2	3				
CO201-	3	2	2			2					1	
CO201-	3			2				2			1	
CO201-	3	2				2		2			1	

1→Low 2→Medium 3→High

19CP2704 WEB ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. Understand the characteristics of web applications
2. Learn to Model web applications
3. Be aware of Systematic design methods
4. Be familiar with the testing techniques for web applications

PRE-REQUISITE:

- Web Technology

UNIT I INTRODUCTION TO WEB ENGINEERING 9

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

UNIT II WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS 9

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Modelling Framework-Modeling languages- Analysis Modeling for Web Apps-The Content Model-The Interaction Model-Configuration Model.

UNIT III WEB APPLICATION DESIGN 9

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines- Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture-structuring- Accessing Information-Navigation Design- Functional Design-Wep App Functionality-Design Process- Functional Architecture- Detailed Functional Design.

UNIT IV TESTING WEB APPLICATIONS 9

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches- Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and

Techniques- Link Testing- Browser Testing-Usability Testing- Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.

UNIT V PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT 9

Introduction-challenges in launching the web Application-Promoting Web Application- Content Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application- Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets.

Total: 45 Periods

REFERENCE BOOK(S):

1. Chris Bates, ―Web Programming: Building Internet Applications‖, Third Edition, Wiley India Edition, 2007.
2. Gerti Kappel, Birgit Proll, ―Web Engineering‖, John Wiley and Sons Ltd, 2006.
3. Guy W. Lecky-Thompson, ―Web Programming‖, Cengage Learning, 2008.
4. John Paul Mueller, ―Web Development with Microsoft Visual Studio 2005‖, Wiley Dream tech, 2006.
5. Roger S. Pressman, David Lowe, ―Web Engineering‖, Tata McGraw Hill Publication, 2007.

COURSE OUTCOME(S):

CO201-4. 1 Describe syntax and semantics of programming languages.

CO201-4. 2 Explain data, data types, and basic statements of programming languages.

CO201-4. 3 Design and implement subprogram constructs, Apply object - oriented, concurrency, pro and event handling programming constructs

CO201-4. 4 Develop programs in LISP, ML, and Prolog

CO201-4. 5 Analyze the challenges in launching web applications.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO201-	3	3	2	2	1	2						3
CO201-	3	3		2		2						3
CO201-			2		1							3
CO201-	2	1	3	2	2							2
CO201-	3	3		2		2						3

1→Low 2→Medium 3→High

19CP2705 REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To learn real time operating system concepts, the associated issues & Techniques.
2. To understand design and synchronization problems in Real Time System.
3. To explore the concepts of real time databases.
4. To understand the evaluation techniques present in Real Time System

PRE-REQUISITE:

- Distributed systems

UNIT I REAL TIME SYSTEM AND SCHEDULING 9

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II SOFTWARE REQUIREMENTS ENGINEERING 9

Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.

UNIT III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT V EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION 9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault– Tolerant

Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

Total: 45 Periods

REFERENCE BOOK(S):

1. C.M. Krishna, Kang G. Shin, ―Real-Time Systems‖, McGraw-Hill International Editions, 1997.
2. Philip.A.Laplante, ―Real Time System Design and Analysis‖, Prentice Hall of India, 3rd Edition, 2004.
3. Rajib Mall, ―Real-time systems: theory and practice‖, Pearson Education, 2009.
4. R.J.A Buhur, D.L Bailey, ―An Introduction to Real-Time Systems‖, Prentice Hall International, 1999.
5. Stuart Bennett, ―Real Time Computer Control-An Introduction‖, Prentice Hall of India, 1998.
6. Allen Burns, Andy Wellings, ―Real Time Systems and Programming Languages‖, Pearson Education, 2003.

COURSE OUTCOME(S):

CO202-1. 1 Apply principles of real time system design techniques to develop real time applications.

CO202-1. 2 Make use of database in real time applications.

CO202-1. 3 Make use of architectures and behaviour of real time operating systems

CO202-1. 4 Analyze the issues in real time databases.

CO202-1. 5 Apply evaluation techniques in application

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202-	3	2	1	2	2	2					3	3
CO202-	2	3	3			2					2	3
CO202-	3										2	3
CO202-	2	3	3			2					2	3
CO202-		3	2	2							3	2

1→Low 2→Medium 3→High

19CP2706 MOBILE AND PERVASIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

1. To learn the basic architecture and concepts till Third Generation Communication systems.
2. To understand the latest 4G Telecommunication System Principles.
3. To introduce the broad perspective of pervasive concepts and management

4. To explore the HCI in Pervasive environment
5. To apply the pervasive concepts in mobile environment

PRE-REQUISITE:

- Mobile Computing

UNIT I INTRODUCTION 9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM 9

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA.

UNIT III PERVASIVE CONCEPTS AND ELEMENTS 9

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction - Pervasive Transaction Processing - Infrastructure and Devices - Wireless Networks - Middleware for Pervasive Computing Systems - Resource Management - User Tracking- Context Management -Service Management - Data Management - Security Management – Pervasive Computing Environments - Smart Car Space - Intelligent Campus.

UNIT IV HCI IN PERVASIVE COMPUTING 9

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - Context- Driven HCI Service Selection - Interaction Service Selection Overview - User Devices - Service-Oriented Middleware Support - User History and Preference - Context Manager - Local Service Matching - Global Combination - Effective Region - User Active Scope - Service Combination Selection Algorithm.

UNIT V PERVASIVE MOBILE TRANSACTIONS 9

Pervasive Mobile Transactions - Introduction to Pervasive Transactions - Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework - Context-Aware Pervasive Transaction Model - Context Model for Pervasive Transaction Processing - Context-Aware Pervasive Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism - Coordination Algorithm for Pervasive

Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition.

Total: 45 Periods

REFERENCE BOOK(S):

1. Alan Colman, Jun Han, and Muhammad Ashad Kabir, Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications, Springer, 2016.
2. J.Schiller, ―Mobile Communication‖, Addison Wesley, 2000.
3. Juha Korhonen, ―Introduction to 4G Mobile Communications‖ , Artech House Publishers, 2014.
4. Kolomvatsos, Kostas, Intelligent Technologies and Techniques for Pervasive Computing, IGI Global, 2013.
5. M. Bala Krishna, Jaime Lloret Mauri, ―Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks‖, CRC 2016.
6. Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen, ― Pervasive Computing: Concepts, Technologies and Applications ‖ CRC Press, 2016.

COURSE OUTCOME(S):

CO202-2. 1 Obtain a through understanding of Basic architecture and concepts of till Third Generation Communication systems

CO202-2. 2 Explain the latest 4G Telecommunication System Principles.

CO202-2. 3 Incorporate the pervasive concepts

CO202-2. 4 Implement the HCI in Pervasive environment

CO202-2. 5 Work on the pervasive concepts in mobile environment

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202-	3	3	2	2							2	2
CO202-	2	2		2	2						2	2
CO202-	2	2	2	2							2	2
CO202-	3		3	2							2	2
CO202-	3										2	2

1→Low 2→Medium 3→High

19CP2707 PARALLEL PROGRAMMING PARADIGMS L T P C
3 0 0 3

OBJECTIVES:

1. To familiarize the issues in parallel computing.

2. To describe distributed memory programming using MPI.
3. To understand shared memory paradigm with Pthreads and with OpenMP.
4. To learn the GPU based parallel programming using OpenCL

PRE-REQUISITE:

- Programming Paradigm

UNIT I FOUNDATIONS OF PARALLEL PROGRAMMING 9

Motivation for parallel programming – Need-Concurrency in computing – Basics of processes, multitasking and threads – cache – cache mappings – caches and programs – virtual memory – Instruction level parallelism – hardware multi-threading – Parallel Hardware-SIMD – MIMD – Interconnection networks – cache coherence –Issues in shared memory model and distributed memory model –Parallel Software- Caveats- coordinating processes/ threads- hybrid model – shared memory model and distributed memory model - I/O – performance of parallel programs-– parallel program design.

UNIT II DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD- programs– MPI_Send and MPI_Recv – message matching – MPI- I/O – parallel I/O – collective communication – Tree-structured communication -MPI_Reduce – MPI_Allreduce, broadcast, scatter, gather, allgather – MPI derived types – dynamic process management – performance evaluation of MPI programs- A Parallel Sorting Algorithm.

UNIT III SHARED MEMORY PARADIGM WITH PTHREADS 9

Basics of threads, Pthreads – thread synchronization – critical sections – busy waiting – mutex – semaphores – barriers and condition variables – read write locks with examples - Caches, cache coherence and false sharing – Thread safety-Pthreads case study.

UNIT IV SHARED MEMORY PARADIGM: OPENMP 9

Basics OpenMP – Trapezoidal Rule-scope of variables – reduction clause – parallel for directive – loops in OpenMP – scheduling loops –Producer Consumer problem – cache issues – threads safety in OpenMP – Two- body solvers- Tree Search.

UNIT V GRAPHICAL PROCESSING PARADIGMS: OPENCL AND INTRODUCTION TO CUDA 9

Introduction to OpenCL – Example-OpenCL Platforms- Devices-Contexts - OpenCL programming – Built-In Functions-Programs Object and Kernel Object – Memory Objects - Buffers and Images – Event model – Command-Queue - Event Object - case study. Introduction to CUDA programming.

Total: 45 Periods

REFERENCE BOOK(S):

1. A. Munshi, B. Gaster, T. G. Mattson, J. Fung, and D. Ginsburg, ―OpenCL programming guide‖, Addison Wesley, 2011.
2. M. J. Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill, 2003.
3. Peter S. Pacheco, ―An introduction to parallel programming‖, Morgan Kaufmann, 2011.
4. Rob Farber, ―CUDA application design and development‖, Morgan Haufmann, 2011.
5. W. Gropp, E. Lusk, and A. Skjellum, ―Using MPI: Portable parallel programming with the message passing interface‖, Second Edition, MIT Press, 1999.

COURSE OUTCOME(S):

CO202-3. 1 Identify issues in parallel programming

CO202-3. 2 Develop distributed memory programs using MPI framework.

CO202-3. 3 Design and develop shared memory parallel programs using Pthreads

CO202-3. 4 Design and develop shared memory parallel programs using OpenMP

CO202-3. 5 Implement Graphical Processing OpenCL programs

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202-	3	2		2		1					1	2
CO202-	3		3		2	1					1	2
CO202-	3		3		2	2					1	2
CO202-												
CO202-	3				2	3					1	2

1→Low 2→Medium 3→High

19CP2708 INFORMATION RETRIEVAL TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

1. To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
2. To get an understanding of machine learning techniques for text classification and clustering.

3. To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
4. To understand the concepts of digital libraries

PRE-REQUISITE:

- Database Management Systems

UNIT I INTRODUCTION: MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

UNIT II MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.

UNIT III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

UNIT IV CLASSIFICATION AND CLUSTERING 9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

UNIT V SEARCHING THE WEB 9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries.

Total: 45 Periods

REFERENCE BOOK(S):

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, ―Introduction to Information Retrieval‖, Cambridge University Press, First South Asian Edition, 2008.

2. Implementing and Evaluating Search Engines‖, The MI Cambridge, Massachusetts London, England, 2010.
3. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, ―Modern Information Retrieval: The concepts and Technology behind Search‖ (ACM Press Books), Second Edition, 2011.
4. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, ―Information Retrieval.

COURSE OUTCOME(S):

CO202-4. 1 Build an Information Retrieval system using the available tools

CO202-4. 2 Identify and design the various components of an Information Retrieval system.

CO202-4. 3 Analyze the Information Retrieval with regard to indexing.

CO202-4. 4 Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval

CO202-4. 5 Design an efficient search engine and analyze the Web content structure

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202-	3		2		2	2					1	2
CO202-	3		3			1					1	2
CO202-	3		2			1					1	2
CO202-	3		2			1					1	2
CO202-	3		3			1					1	2

1→Low 2→Medium 3→High

19CP2709 SOFTWARE ARCHITECTURES AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the need, design approaches for software architecture to bridge the dynamic requirements and implementation.
2. To learn the design principles and to apply for large scale systems
3. To design architectures for distributed heterogeneous systems ,environment through brokerage interaction
4. To build design knowledge on service oriented and model driven architectures and the aspect oriented architecture.
5. To develop appropriate architectures for various Case studies like semantic web services, supply chain cloud services.

PRE-REQUISITE:

- Distributed Systems

UNIT I INTRODUCTION TO SOFTWARE ARCHITECTURE 9

Introduction to Software Architecture-Bridging Requirements and Implementation, Design Guidelines, Software Quality attributes. Software Architecture Design Space. Agile Approach to Software Architecture Design, Models for Software Architecture Description Languages (ADL).

UNIT II OBJECT ORIENTED PARADIGM 9

Object-Oriented Paradigm -Design Principles. Data-Centered Software Architecture: Repository Architecture, Blackboard Architecture. Hierarchical Architecture Main-Subroutine, Master-Slave, Layered, Virtual Machine. Interaction-Oriented Software Architectures: Model-View-Controller (MVC), Presentation-Abstraction-Control (PAC).

UNIT III DISTRIBUTED ARCHITECTURE 9

Distributed Architecture: Client-Server, Middleware, Multi-tiers, Broker Architecture – MOM,CORBA Message Broker Architecture- Service-Oriented Architecture (SOA), SOAP, UDDI, SOA Implementation in Web Services, Grid/cloud Service Computing. Heterogeneous Architecture-Methodology of Architecture Decision, Quality Attributes.

UNIT IV USER INTERFACES AND CONTAINERS 9

Architecture of User Interfaces containers, case study-web service. Product Line Architectures - methodologies, processes and tools. Software Reuse and Product Lines -Product Line Analysis, Design and implementation, configuration Models. Model Driven Architectures (MDA) –why MDA- Model transformation and software architecture, SOA and MDA. Eclipse modeling framework.

UNIT V ASPECT ORIENTED ARCHITECTURE 9

Aspect Oriented Architectures- AOP in UML,AOP tools, Architectural aspects and middleware Selection of Architectures, Evaluation of Architecture Designs, Case Study: Online Computer Vendor, order processing, manufacture &shipping –inventory, supply chain cloud service Management, semantic web services.

Total: 45 Periods

REFERENCE BOOK(S):

1. Essentials of software Architecture , Ion Gorton, Second Edition, Springer-verlag, 2011.
2. Software Architecture Design Illuminated, Kai Qian Jones and Bartlett Publishers Canada, 2010.

COURSE OUTCOME(S):

CO202-5. 1 Understand the need of software architecture for sustainable dynamic systems

CO202-5. 2 Have a sound knowledge on design principles and to apply for large scale systems.

CO202-5. 3 Design architectures for distributed heterogeneous systems

CO202-5. 4 Have good knowledge on service oriented and model driven architectures and the aspect oriented architecture

CO202-5. 5 Have a working knowledge to develop appropriate architectures through various case studies.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO202-	3										1	2
CO202-	3			2							1	2
CO202-	3		2								1	2
CO202-	3			2							1	2
CO202-	3			2							1	2

1→Low 2→Medium 3→High

19CP3701 PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

1. To understand the mathematical foundations needed for performance evaluation of computer systems
2. To understand the metrics used for performance evaluation
3. To understand the analytical modeling of computer systems
4. To enable the students to develop new queuing analysis for both simple and complex systems
5. To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling Policies

PRE-REQUISITE:

- Networks

UNIT I OVERVIEW OF PERFORMANCE EVALUATION 9

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample

Paths, Convergence and Averages – Little‘s Law and other Operational Laws – Modification for Closed Systems.

UNIT II MARKOV CHAINS AND SIMPLE QUEUES 9

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1.

UNIT III MULTI-SERVER AND MULTI-QUEUE SYSTEMS 9

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke‘s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues.

UNIT IV REAL-WORLD WORKLOADS 9

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Alalytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.

UNIT V SMART SCHEDULING IN THE M/G/1 9

Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies -

. Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness.

Total: 45 Periods

REFERENCE BOOK(S):

1. K. S. Trivedi, ―Probability and Statistics with Reliability, Queueing and Computer Science Applications‖, John Wiley and Sons, 2001.
2. Krishna Kant, ―Introduction to Computer System Performance Evaluation‖, McGraw-Hill, 1992.
3. Lieven Eeckhout, ―Computer Architecture Performance Evaluation Methods‖, Morgan and Claypool Publishers, 2010.
4. Mor Harchol - Balter, ―Performance Modeling and Design of Computer Systems – Queueing Theory in Action‖, Cambridge University Press, 2013.
5. Paul J. Fortier and Howard E. Michel, ―Computer Systems Performance Evaluation and Prediction‖, Elsevier, 2003.
6. Raj Jain, ―The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling‖, Wiley-Interscience, 1991.

COURSE OUTCOME(S):

CO303-1. 1 Identify the need for performance evaluation and the metrics used for it

CO303-1. 2 Distinguish between open and closed queuing networks

CO303-1. 3 Use Little's law and other operational laws

CO303-1. 4 Use discrete-time and continuous-time Markov chains to model real world systems

CO303-1. 5 Develop analytical techniques for evaluating scheduling Policies.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO303-	3	2		2							1	1
CO303-	3			2							1	1
CO303-	3										1	1
CO303-	3										1	1
CO303-	3		3		1						1	1

1→Low 2→Medium 3→High

19CP3702 LANGUAGE TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:

1. To learn the fundamentals of natural language processing
2. To appreciate the use of CFG and PCFG in NLP
3. To understand the role of semantics and pragmatics

PRE-REQUISITE:

- Programming Languages

UNIT I INTRODUCTION 9

Words - Regular Expressions and Automata - Words and Transducers - N-grams - Part-of- Speech – Tagging - Hidden Markov and Maximum Entropy Models.

UNIT II SPEECH 9

Speech – Phonetics - Speech Synthesis - Automatic Speech Recognition - Speech Recognition: - Advanced Topics - Computational Phonology.

UNIT III SYNTAX 9

Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity.

UNIT IV SEMANTICS AND PRAGMATICS 9

The Representation of Meaning - Computational Semantics - Lexical Semantics - Computational Lexical Semantics - Computational Discourse.

UNIT V APPLICATIONS 9

Information Extraction - Question Answering and Summarization - Dialogue and Conversational Agents - Machine Translation.

Total: 45 Periods

REFERENCE BOOK(S):

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Daniel Jurafsky, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.
4. Richard M Reese, "Natural Language Processing with Java", O_Reilly Media, 2015.
5. Steven Bird, Ewan Klein and Edward Loper, -"Natural Language Processing with Python", First Edition, O_Reilly Media, 2009.

COURSE OUTCOME(S):

CO303-2. 1 To tag a given text with basic Language features

CO303-2. 2 To design an innovative application using NLP components

CO303-2. 3 To implement a rule based system to tackle morphology/syntax of a language

CO303-2. 4 To design a tag set to be used for statistical processing for real-time applications

CO303-2. 5 To compare and contrast use of different statistical approaches for different types of NLP applications

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO303-	3										1	2
CO303-	3		3								1	2
CO303-	3										1	2
CO303-	3		3								1	2
CO303-	3			2							1	2

1→Low 2→Medium 3→High

19CP3703 COMPUTER VISION

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To review image processing techniques for computer vision.
2. To understand shape and region analysis.
3. To understand Hough Transform and its applications to detect lines, circles, ellipses.
4. To understand three-dimensional image analysis techniques.
5. To understand motion analysis.
6. To study some applications of computer vision algorithms

PRE-REQUISITE:

- Image Processing

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques edge detection techniques – corner and interest Point detection – mathematical morphology – texture.

UNIT II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection accurate center location – speed problem – ellipse detection – Case study: Human Iris location hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – Point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V APPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Total: 45 Periods

REFERENCE BOOK(S):

1. D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.
2. E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
3. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.
4. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.
5. R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011.
6. Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.

COURSE OUTCOME(S):

CO303-3. 1 Implement fundamental image processing techniques required for computer vision.

CO303-3. 2 Perform shape analysis and implement boundary tracking techniques

CO303-3. 3 Apply Hough Transform for line, circle, and ellipse detections

CO303-3. 4 Apply 3D vision techniques

CO303-3. 5 Develop applications using computer vision techniques

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO303-	3		2								1	2
CO303-	3	3		3							1	2
CO303-	3										1	2
CO303-	3										1	2
CO303-	3		2								1	2

1→Low 2→Medium 3→High

19CP3704 SPEECH PROCESSING AND SYNTHESIS

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the mathematical foundations needed for speech processing
2. To understand the basic concepts and algorithms of speech processing and synthesis
3. To familiarize the students with the various speech signal representation, coding and recognition techniques
4. To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing

PRE-REQUISITE:

- Digital Signal Processing

UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9

Introduction – SPO11en Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

UNIT III SPEECH RECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNIT IV TEXT ANALYSIS 9

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation.

UNIT V SPEECH SYNTHESIS 9

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

Total: 45 Periods

REFERENCE BOOK(S):

1. Joseph Mariani, ―Language and Speech Processing‖, Wiley, 2009.
2. Lawrence Rabiner and Biing-Hwang Juang, ―Fundamentals of Speech Recognition‖, Prentice Hall Signal Processing Series, 1993.
3. Sadaoki Furui, ―Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications)‖, Marcel Dekker, 2000.
4. Thomas F.Quatieri, ―Discrete-Time Speech Signal Processing‖, Pearson Education,2002.
5. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, ―Spoken Language Processing – A guide to Theory, Algorithm and System Development‖, Prentice Hall PTR, 2001.

COURSE OUTCOME(S):

CO303-4. 1 Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word.

CO303-4. 2 Determine and apply Mel-frequency cepstral coefficients for processing all types of signals

CO303-4. 3 Justify the use of formant and concatenative approaches to speech synthesis

CO303-4. 4 Identify the apt approach of speech synthesis depending on the language to be processed

CO303-4. 5 Determine the various encoding techniques for representing speech

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO303-	3	3									1	2
CO303-	3										1	2
CO303-	3	3									1	2
CO303-	3	3									1	2
CO303-	3										1	2

1→Low 2→Medium 3→High

19CP3705 SOFTWARE QUALITY ASSURANCE AND TESTING L T P C
3 0 0 3

OBJECTIVES:

1. To understand the basics of testing, test planning &design and test team organization
2. To study the various types of test in the life cycle of the software product.
3. To build design concepts for system testing and execution
4. To learn the software quality assurance ,metrics, defect prevention techniques
5. To learn the techniques for quality assurance and applying for applications

PRE-REQUISITE:

- Software Testing

UNIT I SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES 9

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building.

UNIT II SYSTEM TESTING 9

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models.

UNIT III SYSTEM TEST CATEGORIES 9

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. system test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

UNIT IV SOFTWARE QUALITY 9

Software quality - People‘s Quality Expectations**,** Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement ,Testing Maturity Model.

UNIT V SOFTWARE QUALITY ASSURANCE 9

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control,

Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities**.** QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

Total: 45 Periods

REFERENCE BOOK(S):

1. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008.
2. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
3. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004.
4. Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011.

COURSE OUTCOME(S):

CO303-5. 1 Perform functional and nonfunctional tests in the life cycle of the software product.

CO303-5. 2 Understand system testing and test execution process.

CO303-5. 3 Identify defect prevention techniques and software quality assurance metrics.

CO303-5. 4 Identify the software quality assurance metrics and defect prevention techniques

CO303-5. 5 Apply techniques of quality assurance for typical applications

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO303-5. 1	3					1				2	1	2
CO303-5. 2	3	2								1	1	2
CO303-5. 3	3	2				1					1	2
CO303-5. 4	3	2				1					1	2
CO303-5. 5	3		3	2		1					1	2

1→Low 2→Medium 3→High

19CP3706 FORMAL MODELS OF SOFTWARE SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.
2. To understand the fundamentals of abstraction and formal systems

3. To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
4. To understand formal specification models based on set theory, calculus and algebra and apply to a case study
5. To learn Z, Object Z and B Specification languages with case studies

PRE-REQUISITE:

- Artificial Intelligence

UNIT I SPECIFICATION FUNDAMENTALS 9

Role of Specification- Software Complexity - Size, Structural, Environmental, Application, domain, Communication Complexity, How to Control Complexity. Software specification, Specification Activities-Integrating Formal Methods into the Software Life-Cycle. Specification Qualities- Process Quality Attributes of Formal Specification Languages, Model of Process Quality, Product Quality and Utility, Conformance to Stated Goals Quality Dimensions and Quality Model.

UNIT II FORMAL METHODS 9

Abstraction- Fundamental Abstractions in Computing. Abstractions for Software Construction. Formalism Fundamentals - Formal Systems, Formalization Process in Software Engineering Components of a Formal System- Syntax, Semantics, and Inference Mechanism. Properties of Formal Systems - Consistency. Automata-Deterministic Finite Accepters, State Machine Modeling Nondeterministic Finite Accepters, Finite State Transducers Extended Finite State Machine. Case Study—Elevator Control. Classification of C Methods-Property-Oriented Specification Methods, Model-Based Specification Techniques

UNIT III LOGIC 9

Propositional Logic - Reasoning Based on Adopting a Premise, Inference Based on Natural Deduction. Predicate Logic - Syntax and Semantics, Policy Language Specification, knowledge Representation Axiomatic Specification. Temporal Logic -.Temporal Logic for Specification and Verification, Temporal Abstraction Propositional Temporal Logic (PTL), First Order Temporal Logic (FOTL).Formal Verification, Verification of Simple FOTL, Model Checking, Program Graphs, Transition Systems.

UNIT IV SPECIFICATION MODELS 9

Mathematical Abstractions for Model-Based Specifications-Formal Specification Based on Set Theory, Relations and Functions. Property-Oriented Specifications- Algebraic Specification, Properties of Algebraic Specifications, Reasoning, Structured Specifications. Case Study—A Multiple Window Environment: requirements, Modeling Formal Specifications. Calculus of Communicating Systems:

Specific Calculus for Concurrency. Operational Semantics of Agents, Simulation and Equivalence, Derivation Trees, Labeled Transition Systems.

UNIT V FORMAL LANGUAGES 9

The Z Notation, abstractions in Z, Representational Abstraction, Types, Relations and Functions, Sequences, Bags. Free Types-Schemas, Operational Abstraction -Operations Schema Decorators, Generic Functions, Proving Properties from Z specifications, Consistency of Operations. Additional Features in Z. Case Study: An Automated Billing System. The Object-Z Specification Language- Basic Structure of an Object-Z, Specification. Parameterized Class, Object-Orientation, composition of Operations-Parallel Communication Operator, Nondeterministic Choice Operator, and Environment Enrichment. The B-Method -Abstract Machine Notation (AMN), Structure of a B Specification, arrays, statements. Structured Specifications, Case Study- A Ticketing System in a Parking.

Total: 45 Periods

REFERENCE BOOK(S):

1. Mathematical Logic for computer science ,second edition, M.Ben-Ari ,Springer,2003.
2. Logic in Computer Science- modeling and reasoning about systems, 2nd Edition, Cambridge University Press, 2004.
3. Specification of Software Systems, V.S. Alagar, K. Periyasamy, David Grises and Fred B Schneider, Springer –Verlag London, 2011.
4. The ways Z: Practical programming with formal methods, Jonathan Jacky, Cambridge University Press,1996.
5. Using Z-Specification Refinement and Proof,Jim Woodcock and Jim Devies Prentice Hall, 1996.
6. Z: An introduction to formal methods, Second Edition, Antoi Diller, Wiley, 1994.

COURSE OUTCOME(S):

CO304-1. 1 Understand the complexity of software systems, the need for formal specifications activities and qualities to control complexity

CO304-1. 2 Gain knowledge on fundamentals of abstraction and formal systems

CO304-1. 3 Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems

CO304-1. 4 Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study

CO304-1. 5 Have working knowledge on Z, Object Z and B Specification languages with case studies.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO304-1. 1	3				2						1	2
CO304-1. 2	3				2						1	2
CO304-1. 3	3				2						1	2
CO304-1. 4	3		3	2							1	2
CO304-1. 5	3				2						1	2

1→Low 2→Medium 3→High

19CP3707 EMBEDDED SOFTWARE DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

1. To understand the architecture of embedded processor, microcontroller and peripheral devices.
2. To interface memory and peripherals with embedded systems.
3. To study the embedded network environment.
4. To understand challenges in Real time operating systems.
5. To study, analyze and design applications on embedded systems

PRE-REQUISITE:

- Embedded System

UNIT I EMBEDDED PROCESSORS 9

Embedded Computers - Characteristics of Embedded Computing Applications - Challenges in Embedded Computing System Design - Embedded System Design Process- Formalism for System Design - Structural Description - Behavioural Description - ARM Processor - Intel ATOM Processor.

UNIT II EMBEDDED COMPUTING PLATFORM 9

CPU Bus Configuration - Memory Devices and Interfacing - Input/Output Devices and Interfacing - System Design - Development and Debugging – Emulator – Simulator - JTAG Design Example – Alarm Clock - Analysis and Optimization of Performance - Power and Program Size.

UNIT III EMBEDDED NETWORK ENIVIRONMENT 9

Distributed Embedded Architecture - Hardware And Software Architectures - Networks for Embedded Systems - I2C - CAN Bus - SHARC Link Supports – Ethernet – Myrinet – Internet - Network-based Design - Communication Analysis - System Performance Analysis - Hardware Platform Design - Allocation and Scheduling - Design Example - Elevator Controller.

UNIT IV REAL-TIME CHARACTERISTICS 9

Clock Driven Approach - Weighted Round Robin Approach - Priority Driven Approach - Dynamic versus Static Systems - Effective Release Times and Deadlines - Optimality of the Earliest Deadline First (EDF) Algorithm - Challenges in Validating Timing Constraints in Priority Driven Systems - Off-Line versus On-Line Scheduling.

UNIT V SYSTEM DESIGN TECHNIQUES 9

Design Methodologies - Requirement Analysis – Specification - System Analysis and Architecture Design - Quality Assurance - Design Examples - Telephone PBX - Ink jet printer - Personal Digital Assistants - Set-Top Boxes.

Total: 45 Periods

REFERENCE BOOK(S):

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley Publication, First edition, 2013
2. Andrew N Sloss, D. Symes, C. Wright, ‖ Arm system developers guide‖, Morgan Kauffman/Elsevier, 2006.
3. ArshdeepBahga, Vijay Madisetti, " Internet of Things: A Hands-on-Approach" VPT First Edition, 2014
4. C. M. Krishna and K. G. Shin, ―Real-Time Systems‖ , McGraw-Hill, 1997
5. Frank Vahid and Tony Givargis, ―Embedded System Design: A Unified Hardware/Software Introduction‖, John Wiley & Sons.
6. Jane.W.S. Liu, ―Real-Time systems‖, Pearson Education Asia.
7. Michael J. Pont, ―Embedded C‖, Pearson Education , 2007.
8. Steve Heath, ―Embedded SystemDesign‖ , Elsevier, 2005
9. Wayne Wolf, ―Computers as Components:Principles of Embedded Computer System Design‖, Elsevier, 2006.

COURSE OUTCOME(S):

CO304-2. 1	Understand different architectures of embedded processor, microcontroller and peripheral devices.
CO304-2. 2	Interface memory and peripherals with embedded systems.
CO304-2. 3	Work with embedded network environment.
CO304-2. 4	Understand challenges in Real time operating systems.
CO304-2. 5	Design and analyze applications on embedded systems.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO304-2. 1	2	1		1		1					2	3
CO304-2. 2	2	1		1		1					2	3
CO304-2. 3	2	2		1		1					2	2
CO304-2. 4	3	2		1		1					1	2
CO304-2. 5	2	1	3	2		1					2	2

1→Low 2→Medium 3→High

19CP3708 SOCIAL NETWORK ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

1. To understand the components of the social network.
2. To model and visualize the social network.
3. To mine the users in the social network.
4. To understand the evolution of the social network.
5. To know the applications in real time systems

PRE-REQUISITE:

- Web Technology

UNIT I INTRODUCTION 9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

UNIT II MODELING AND VISUALIZATION 9

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III MINING COMMUNITIES 9

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks -

Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT IV EVOLUTION 9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V APPLICATIONS 9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

Total: 45 Periods

REFERENCE BOOK(S):

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, ―Computational Social Network Analysis: Trends, Tools and Research Advances‖, Springer, 2012.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖,Springer, 1st edition, 2011.
3. Charu C. Aggarwal, ―Social Network Data Analytics‖, Springer; 2014.
4. Giles, Mark Smith, John Yen, ―Advances in Social Network Mining and Analysis‖, Springer, 2010.
5. Guandong Xu , Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, Springer, 1st edition, 2012.
6. Peter Mika, ―Social Networks and the Semantic Web‖, Springer, 1st edition, 2007.
7. Przemyslaw Kazienko, Nitesh Chawla,‖Applications of Social Media and Social Network Analysis‖, Springer,2015.

COURSE OUTCOME(S):

CO304-3. 1 Work on the internals components of the social network.

CO304-3. 2 Model and visualize the social network

CO304-3. 3 Mine the behaviour of the users in the social network

CO304-3. 4 Predict the possible next outcome of the social network

CO304-3. 5 Apply social network in real time applications.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO304-3. 1	2		3								2	2
CO304-3. 2	2		3		1						2	2
CO304-3. 3	1										2	2
CO304-3. 4	2										2	2
CO304-3. 5	2		2	2							3	1

1→Low 2→Medium 3→High

19CP3709 COMPILER OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

1. To be aware of different forms of intermediate languages and analyzing programs.
2. To understand optimizations techniques for simple program blocks.
3. To apply optimizations on procedures, control flow and parallelism.
4. To learn the inter procedural analysis and optimizations.
5. To explore the knowledge about resource utilization

PRE-REQUISITE:

- Compiler Design

UNIT I INTERMEDIATE REPRESENTATIONS AND ANALYSIS 9

Review of Compiler Structure- Structure of an Optimizing Compiler – Intermediate Languages - LIR, MIR, HIR – Control Flow Analysis – Iterative Data Flow Analysis – Static Single Assignment – Dependence Relations - Dependences in Loops and Testing-Basic Block Dependence DAGs – Alias Analysis.

UNIT II EARLY AND LOOP OPTIMIZATIONS 9

Importance of Code Optimization Early Optimizations: Constant-Expression Evaluation - Scalar Replacement of Aggregates - Algebraic Simplifications and Re-association - Value Numbering - Copy Propagation - Sparse Conditional Constant Propagation. Redundancy Elimination: Common - Subexpression Elimination - Loop-Invariant Code Motion - Partial- Redundancy Elimination - Redundancy Elimination and Reassociation - Code Hoisting. Loop Optimizations: Induction Variable Optimizations - Unnecessary Bounds Checking Elimination.

UNIT III PROCEDURE OPTIMIZATION AND SCHEDULING 9

Procedure Optimizations: Tail-Call Optimization and Tail-Recursion Elimination - Procedure Integration - In-Line Expansion - Leaf-Routine Optimization and Shrink Wrapping. Code Scheduling: Instruction Scheduling - Speculative Loads and Boosting - Speculative Scheduling - Software Pipelining - Trace Scheduling - Percolation Scheduling. Control-Flow and Low-Level Optimizations : Unreachable-Code Elimination - Straightening - If Simplifications - Loop Simplifications -Loop Inversion – Un-switching - Branch Optimizations Tail Merging or Cross Jumping - Conditional Moves - Dead-Code Elimination - Branch Prediction - Machine Idioms and Instruction Combining..

UNIT IV INTER PROCEDURAL OPTIMIZATION 9

Symbol table – Runtime Support - Interprocedural Analysis and Optimization: Interprocedural Control Flow Analysis - The Call Graph - Interprocedural Data-Flow Analysis Interprocedural Constant Propagation - Interprocedural Alias Analysis - Interprocedural Optimizations - Interprocedural Register Allocation - Aggregation of Global References.

UNIT V REGISTER ALLOCATION AND OPTIMIZING FOR MEMORY 9

Register Allocation: Register Allocation and Assignment - Local Methods - Graph Coloring – Priority Based Graph Coloring - Other Approaches to Register Allocation. Optimization for the Memory Hierarchy: Impact of Data and Instruction Caches - Instruction-Cache Optimization - Scalar Replacement of Array Elements - Data-Cache Optimization - Scalar vs. Memory-Oriented Optimizations.

Total: 45 Periods

REFERENCE BOOK(S):

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Addison Wesley, Second Edition, 2007.
2. Andrew W. Appel, Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2002.
3. Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition, 2011. 5. Randy Allen and Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence based Approach‖, Morgan Kaufman, 2001.
4. Robert Morgan ,‖Building an Optimizing Compiler‖, Digital Press, 1998
5. Steven Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufman Publishers, 1997.

COURSE OUTCOME(S):

CO304-4. 1 Identify the different optimization techniques for simple program blocks

CO304-4. 2 Design performance enhancing optimization techniques

CO304-4. 3 Perform the optimization on procedures

CO304-4. 4 Perform the inter procedural analysis and optimizations

CO304-4. 5 Ensure better utilization of resources

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO304-4. 1	2	2		1								2
CO304-4. 2	2		2								1	1
CO304-4. 3	2		1									1
CO304-4. 4	2		1									1
CO304-4. 5	3	2		2								2

1→Low 2→Medium 3→High

19CP3710 BIO-INSPIRED COMPUTING L T P C
3 0 0 3

OBJECTIVES:

1. To Learn bio-inspired theorem and algorithms
2. To Understand random walk and simulated annealing
3. To Learn genetic algorithm and differential evolution
4. To Learn swarm optimization and ant colony for feature selection
5. To understand bio-inspired application in image processing

PRE-REQUISITE:

- Image Processing

UNIT I INTRODUCTION 9

Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Mataheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

UNIT II RANDOM WALK AND ANEALING 9

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling.

UNIT III GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION 9

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA varients -

schema theorem - convergence analysis - introduction to differential evolution - varients - choice of parameters - convergence analysis - implementation.

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - varients- Ant colony optimization toward feature selection.

UNIT V APPLICATION IN IMAGE PROCESSING 9

Bio-Inspired Computation and its Applications in Image Processing: An Overview - Fine- Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Thresholded Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search.

Total: 45 Periods

REFERENCE BOOK(S):

1. Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013
3. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016
4. Xin-She Yang, "Nature Ispired Optimization Algorithm,Elsevier First Edition 2014
5. Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

COURSE OUTCOME(S):

CO304-5. 1 To Implement and apply bio-inspired algorithms

CO304-5. 2 To Explain random walk and simulated annealing

CO304-5. 3 To Implement and apply genetic algorithms

CO304-5. 4 To Explain swarm intelligence and ant colony for feature selection

CO304-5. 5 Apply bio-inspired techniques in image processing.

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO304-5. 1	2	2		1								2

CO304-5. 2	2		2								1	1
CO304-5. 3	2		1									1
CO304-5. 4	3	2		2								2
CO304-5. 5	2		2								1	1

1→Low 2→Medium 3→High

19CP3711 DATA VISUALIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

1. To develop skills to both design and critique visualizations.
2. To introduce visual perception and core skills for visual analysis.
3. To understand visualization for time-series analysis.
4. To understand visualization for ranking analysis.
5. To understand visualization for deviation analysis.
6. To understand visualization for distribution analysis.
7. To understand visualization for correlation analysis.
8. To understand visualization for multivariate analysis.
9. To understand issues and best practices in information dashboard design.

PRE-REQUISITE:

- Cloud Computing

UNIT I CORE SKILLS FOR VISUAL ANALYSIS 9

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT II TIME-SERIES, RANKING, AND DEVIATION ANALYSIS 9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

UNIT III DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns –

correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT IV INFORMATION DASHBOARD DESIGN 9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

UNIT V INFORMATION DASHBOARD DESIGN 9

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

Total: 45 Periods

REFERENCE BOOK(S):

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Edward R. Tufte, “The visual display of quantitative information”, Second Edition, Graphics Press, 2001.
3. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
4. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
5. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
6. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.
7. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
8. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014.

COURSE OUTCOME(S):

CO305-1. 1 To Explain principles of visual perception

CO305-1. 2 To Apply core skills for visual analysis

CO305-1. 3 To Apply visualization techniques for various data analysis tasks

CO305-1. 4 To Design information dashboard

CO305-1. 5 To analyze the Information Dashboard Display Media

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO305-1. 1	2											1
CO305-1. 2	2			2							2	1
CO305-1. 3	3			2							2	1
CO305-1. 4	2		3	2	2							1
CO305-1. 5	2		3	2	2							1

1→Low 2→Medium 3→High

19CP3712 RECONFIGURABLE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

1. To understand the need for reconfigurable computing
2. To expose the students to various device architectures
3. To examine the various reconfigurable computing systems
4. To understand the different types of compute models for programming reconfigurable architectures
5. To expose the students to HDL programming and familiarize with the development environment
6. To expose the students to the various placement and routing protocols
7. To develop applications with FPGAs

PRE-REQUISITE:

- Computer architecture and organization

UNIT I DEVICE ARCHITECTURE 9

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.

UNIT II RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS 9

Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.

UNIT III PROGRAMMING RECONFIGURABLE SYSTEMS 9

Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing Operating System Support for Reconfigurable Computing.

UNIT IV MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS 9

The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools.

UNIT V APPLICATION DEVELOPMENT WITH FPGAS 9

Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs.

Total: 45 Periods

REFERENCE BOOK(S):

1. Christophe Bobda, ―Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications‖, Springer, 2010.
2. Maya B. Gokhale and Paul S. Graham, ―Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays‖, Springer, 2005.
3. FPGA Frontiers: New Applications in Reconfigurable Computing, 2017, Nicole Hemsoth, Timothy Prickett Morgan, Next Platform**.**
4. Reconfigurable Computing: From FPGAs to Hardware/Software Codesign 2011 Edition by Joao Cardoso (Editor), Michael Hübne, Springer
5. Scott Hauck and Andre Dehon (Eds.), ―Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation‖, Elsevier / Morgan Kaufmann, 2008.

COURSE OUTCOME(S):

CO305-2. 1 Identify the need for reconfigurable architectures

CO305-2. 2 Discuss the architecture of FPGAs.

CO305-2. 3 Point out the salient features of different reconfigurable architectures

CO305-2. 4 Build basic modules using any HDL

CO305-2. 5 Develop applications using any HDL and appropriate tools

CO305-2. 6 Design and build an SoPC for a particular application

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO305-2. 1	2		3	3						2	2	
CO305-2. 2	1	2	2		3	3					2	2
CO305-2. 3	2	3	2			3					1	2
CO305-2. 4	2	3	2		2						1	2
CO305-2. 5	2	3	3			2					1	2
CO305-2. 6	2	2	2									2

1→Low 2→Medium 3→High

19CP3713 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

1. Understand system requirements for mobile applications.
2. Generate suitable design using specific mobile development frameworks.
3. Generate mobile application design.
4. Implement the design using specific mobile development frameworks.
5. Deploy the mobile applications in marketplace for distribution

PRE-REQUISITE:

- Java Programming

UNIT I INTRODUCTION 9

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN 9

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN 9

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID 9

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V IOS 9

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

Total: 45 Periods

REFERENCE BOOK(S):

1. Charlie Collins, Michael Galpin and Matthias Kappler, ―Android in Practice‖, DreamTech, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, ―Beginning iOS 6 Development: Exploring the iOS SDK‖, Apress, 2013.
3. http://developer.android.com/develop/index.html**.**
4. James Dovey and Ash Furrow, ―Beginning Objective C‖, Apress, 2012.
5. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,2012
6. Reto Meier, ―PProfessional android Development‖, Wiley-India Edition, 2012

COURSE OUTCOME(S):

CO305-3. 1 Describe the requirements for mobile applications

CO305-3. 2 Explain the challenges in mobile application design and development.

CO305-3. 3 Develop design for mobile applications for specific requirements

CO305-3. 4 Implement the design using Android SDK

CO305-3. 5 Implement the design using Objective C and iOS

CO305-2. 6 Deploy mobile applications in Android and iPhone marketplace for distribution

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO305-3. 1	3		2								2	
CO305-3. 2	3	2										2
CO305-3. 3	3		2								2	3
CO305-3. 4	3		3		2						2	2
CO305-3. 5	3		3		2						2	3
CO305-3. 6	3		3	2	2						2	3

1→Low 2→Medium 3→High

19CP3714 BIO INFORMATICS

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To get exposed to the fundamentals of bioinformatics.
2. To learn bio-informatics algorithm and phylogenetic concept.
3. To understand open problems and issues in replication and molecular clocks.

4. To learn assemble genomes and corresponding theorem.
5. To study and exposed to the domain of human genomics.

PRE-REQUISITE:

- linear algebra and computer programming

UNIT I INTRODUCTION AND FUNDAMENTALS 9

Fundamentals of genes , genomics , molecular evolution – genomic technologies – beginning of bioinformatics - genetic data –sequence data formats – secondary database – examples – data retrival systems – genome browsers.

UNIT II BIOINFORMATICS ALGORITHM AND ANALYSIS 9

Sequence alignment and similarity searching in genomic databases: BLAST and FASTA – additional bioinformatics analysis involving nucleic acid sequences-additional bioinformatics analysis involving protein sequences – Phylogenetic Analysis.

UNIT III DNA REPLICATION AND MOLECULAR CLOCKS 9

Beginning of DNA replication – open problems – multiple replication and finding replication

– computing probabilities of patterns in a string-the frequency array-converting patterns- solving problems- finding frequents words-Big-O notation –case study-The Tower of Hanoi problem.

UNIT IV ASSEMBLE GENOMES AND SEQUENCES 9

Methods of assemble genomes – string reconstruction – De Bruijn graph – Euler‘s theorem – assembling genomes –DNA sequencing technologies – sequence antibiotics – Brute Force Algorithm – Branch and Bound algorithm – open problems – comparing biological sequences- Case Study –Manhattan tourist Problem.

UNIT V HUMAN GENOME 9

Human and mouse genomes-random breakage model of chromosome evolution – sorting by reversals – greedy heuristic approach – break Points- rearrangements in tumor and break Point genomes-break Point graps- synteny block construction -open problems and technologies

Total: 45 Periods

REFERENCE BOOK(S):

1. Ion Mandoiu and Alexander Zelikovsky **,** **“**Computational Methods for Next Generation Sequencing Data Analysis **—** Wiley series 2016.
2. Istvan Miklos,Renyi Institutue, **—**Introduction to algorithms in bioinformatics‖,Springer 2016.

3. Philip Compeau and Pavel pevzner, ―Bioinformatics Algorithms: An Active Learning Approach‖ Second edition volume I , Cousera, 2015.
4. Supratim Choudhuri, ―Bioinformatics For Beginners‖, Elsevier, 2014.

COURSE OUTCOME(S):

CO305-4. 1 Deploy the genomics technologies in Bioinformatics

CO305-4. 2 Able to distinct efficient algorithm and issues

CO305-4. 3 Deploy the replication and molecular clocks in bioinformatics

CO305-4. 4 Work on assemble genomes and sequences

CO305-4. 5 Use the Microarray technologies for genome expression

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO305-4. 1	2	2		2							2	2
CO305-4. 2	3		3	2								
CO305-4. 3	2	3	2	2							2	2
CO305-4. 4	2			2							2	2
CO305-4. 5	2	3	3	2	2						2	2

1→Low 2→Medium 3→High

19CP3715 INFORMATION STORAGE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

1. To understand the storage architecture and available technologies.
2. To learn to establish & manage datacenter.
3. To learn security aspects of storage & data center.

PRE-REQUISITE:

- Cloud Computing

UNIT I STORAGE TECHNOLOGY 9

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

UNIT II STORAGE SYSTEMS ARCHITECTURE 9

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

UNIT III INTRODUCTION TO NETWORKED STORAGE 9

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

UNIT IV INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS 9

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

UNIT V SECURING STORAGE AND STORAGE VIRTUALIZATION 9

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

Total: 45 Periods

REFERENCE BOOK(S):

1. EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley, India, 2010.
2. Marc Farley, ―Building Storage Networks‖, Tata McGraw Hill ,Osborne, 2001.

3. Robert Spalding, ―Storage Networks: The Complete Reference―, Tata McGraw Hill , Osborne, 2003**.**

COURSE OUTCOME(S):

CO305-5. 1 Select from various storage technologies to suit for required application

CO305-5. 2 Apply security measures to safeguard storage & farm.

CO305-5. 3 Analyse QoS on Storage

CO305-5. 4 Analyze Key metrics to monitor for different components in a storage infrastructure

CO305-5. 5 Analyze the Virtualization technologies

PO vs CO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO305-4. 1	3			2								
CO305-4. 2	3	2	3		3							3
CO305-4. 3	3		1	2		1						1
CO305-4. 4	2			2							2	2
CO305-4. 5	2	3	3	2	2						2	2

1→Low 2→Medium 3→High