PMA19101 APPLIED PROBABILITY AND STATISTICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of one dimensional and two dimensional Random Variables.
- provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- use the concepts of multivariate normal distribution and principle components analysis.
- learn different testing Hypothesis.
- analyse multivariate normal density.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9

Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 9

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation – Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES 9

Sampling distributions – Type I and Type II errors – 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 9

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 PERIODS 45

COURSE OUTCOMES

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

- acquire the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.
- evaluate the strength of evidence from the sample and provides a framework for making determinations related to the population.

- understand the notation of the population distribution and Sampling distributions.
- develop efficient algorithms for solving dynamic programming problems, to acquire skills in handling situation involving random variable.

TEXT BOOKS

1. Oliver C.Ibe"Fundamentals of Applied probability and Random Process", Academic Press, (An mprint of Elsevier), 2010.
2. T.Veerarajan "Probability, Statistics and Random Process", 2nd ed, Tata McGraw-Hill, New Delhi 2008.
3. Johnson, R.A., and Gupta.C.B, Miller and Freund's "Probability and Statistics for Engineers,"11th Edition, Pearson Education, Asia 2011.
4. Taha, H.A., "Operations Research, An introduction", 10th edition, Pearson education, New Delhi, 2010.
5. Jay L. Devore, "Probability and Statistics For Engineering and the Sciences", Thomson and Duxbury, 2002.
6. Richard Johnson, Miller & Freund's "Probability and Statistics for Engineer", Prentice – Hall, 7th Edition, 2007.
7. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 5th Edition, 2002.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19101 ADVANCED DATA STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- analyze synchronization and concurrency methods in data structures.
- know advanced data structures such as search tree and strings.
- have an insight of recent activities in the field of heap data structure.
- familiarize with advanced paradigms and data structure used to solve algorithmic problems.
- understand the concept of computational geometry.

UNIT I DATA STRUCTURES AND CONCURRENCY 9

Data Structures and Concurrency – Synchronization: Coarse-Grained Synchronization, Fine-Grained Synchronization, Lazy Synchronization, Non-Blocking Synchronization - Concurrent Queues: Bounded Partial Queues, Unbounded Lock-Free Queues, Dual Data Structures - Concurrent Stacks– Elimination back off Stack.

UNIT II SEARCH TREES AND STRINGS 9

Search Trees – Weight Balanced Trees – Red Black Trees – Finger Trees and Level Linking – Skip Lists – Joining and Splitting Balanced Search Trees – Strings – Tries and Compressed Tries – Dictionaries – Suffix Trees – Suffix Arrays.

UNIT III HEAPS 9

Heaps - Array-Based Heaps - Heap-Ordered Trees and Half-Ordered Trees - Leftist Heaps – Skew Heaps -Binomial Heaps - Changing Keys in Heaps - Fibonacci Heaps - Double-Ended Heap structures – Multidimensional Heaps.

UNIT IV ADVANCED CONCURRENT DATA STRUCTURES 9

Concurrent Hashing – Closed-address hash Sets – Lock-Free Hash Sets – Open-addressed Hash Sets – Lock-Based Concurrent Skip Lists – Lock-Free Concurrent Skip Lists.

UNIT V COMPUTATIONAL GEOMETRY 9

One Dimensional Range Searching - Two Dimensional Range Searching - Constructing a Priority Search Tree - Searching a Priority Search Tree - Priority Range Trees – Quadtrees - k-D Trees.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know various synchronization and concurrent queue methods in data structure.
- understand advanced data structures such as search tree and strings.
- students assess insight of recent activities in the field of heap data structure.

- determine the appropriate data structure for solving a particular set of problems.
- learn the concept of computational geometry in data structure.

REFERENCES

1. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann, 2012.
2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.
3. Jon Kleinberg, "Algorithm Design", Addison-Wesley, 2013.
4. Cormen, Leiserson, Rivest, Stein, “Introduction to Algorithms”, MIT press, 3rd Edition, 2009.
5. Aho, Hopcroft, Ullman, “The Design and Analysis of Computer Algorithms", Pearson, 2015.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19102 ADVANCED DATA STRUCTURES LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- learn implementation of data structures for concurrency.
- study implementation of advanced data structures such as search trees, hash tables, heaps and operations on them.
- learn to implement advanced concurrent data structures and to apply principles of efficient algorithm design and learn various advanced algorithms.

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.

LIST OF EXPERIMENTS

1. Implementation of various locking and synchronization mechanisms for concurrent linked lists, concurrent queues and concurrent stacks.
2. Implementation of weight balanced search trees and skip lists.
3. Implantation of suffix trees and pattern matching
4. Implementation of various heap structures.
5. Implementation of concurrent hashing, concurrent skip lists, and concurrent priority queues.
6. Implementation of approximation and randomized algorithms.
7. Implementation of parallel sorting algorithms.
8. Developing an application involving concurrency and data structures.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- implement concurrent linked lists, stacks, and queues.
- apply operations on different types of heaps and design techniques for advanced algorithms.
- implement and apply data structures for strings and advanced concurrent structures.

REFERENCES

1. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann, 2012.
2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.
3. Gavpai, “Data Structures and Algorithms – Concepts, techniques and Applications”, First Edition, Tata McGraw-Hill, 2008.
4. S.K. Chang, “Data Structures and Algorithms – Series of Software Engineering and Knowledge Engineering”, Vol. 13, World Scientific Publishing, 2003.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3
CO4	3	3	1	3	-	-	1	-	3	-	1	3	3	3

SEMESTER II

PCE19201 ADVANCED ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the introduction of the advanced methods of designing and analysing algorithms.
- familiarize with basic paradigms and data structures used to solve advanced graph problems.
- understand different classes of problems concerning their computation difficulties.
- choose appropriate algorithms and use it for a specific problem.
- know the concept of NP completeness.

UNIT I GRAPH 9

Definitions and Elementary Algorithms: BFS- DFS- BFS and DFS in directed graph –topological sort- strongly connected components – Minimum spanning tree- spanning tree kruskal's algorithm - Prim's algorithm.

UNIT II SHORTEST PATHS 9

Single source shortest paths: existence-properties- Dijikstra algorithm-The bellman- Ford algorithm-single source shortest path in acyclic graphs-All pairs shortest paths: matrix multiplication-The Floyd-Warshall algorithm-transitive closure-Johnson's algorithm.

UNIT III MATROIDS 9

Introduction to greedy paradigm- algorithm to compute a maximum weight maximal independent set - Application to MST-Graph Matching: Algorithm to compute maximum matching- Characterization of maximum matching by augmenting paths- Edmond's Blossom algorithm to compute augmenting path.

UNIT IV FLOW- NETWORKS 9

Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow-to Edmond- Karp maximum -flow algorithm- Matrix Computations: Strassen's algorithm and introduction divide and conquer paradigm- inverse of a triangular matrix- relation between the time complexities of basic matrix operations- LUP-decomposition.

UNIT V LINEAR PROGRAMMING 9

Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples - proof of NP-hardness and NP- Completeness.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the performance of graph algorithms.
- determine the appropriate data structure for solving a particular set of problems.
- categorize the different problems in various classes according to their complexity.
- have an insight of recent activities in the field of the advanced data structure.
- analyze the NP completeness.

REFERENCES

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein,-Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman,-Data Structures and Algorithms‖, Pearson Education, Reprint 2006.
3. Harsh Bhasin,-Algorithms Design and Analysis‖, Oxford university press, 2016.
4. S. Sridhar,-Design and Analysis of Algorithms‖, Oxford university press, 2014.
5. Anany Levitin,-Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19202 WEB ANALYTICS AND DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the fundamental concepts of social network and web analytics.
- explore web analytics tools and implement them.
- understand the searching and retrieval process of web data and its optimization.
- learn the process of making connections and analysing them.
- understand the societal involvements in web analytics and development.

UNIT I INTRODUCTION 9

Introduction – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization.

UNIT II ANALYTICS TOOLS 9

Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys.

UNIT III SEARCH AND RETRIEVAL 9

Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models.

UNIT IV CONNECTIONS 9

Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity.

UNIT V SOCIAL INVOLVEMENTS 9

Connection Search, Collapse, Robustness Social involvements and diffusion of innovation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- become familiar with social networking and web data.
- know the web analytics tools.
- gain knowledge on the searching and retrieval process of web data.
- understand the process of making connections and analyse them.
- understand the societal involvements in web analytics.

REFERENCES

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19203 ADVANCED ALGORITHMS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- know fundamental design, analysis, and implementation of basic data structures.
- understand basic concepts in the specification and analysis of programs.
- know principles for good program design, especially the uses of data abstraction

LIST OF EXPERIMENTS

1. Find the Topological ordering of vertices in a given digraph.
2. Compute the transitive closure of a given directed graph using Warshall's algorithm.
3. Find the shortest paths to other vertices using Dijkstra's algorithm.
4. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
5. Check whether a given graph is connected or not using DFS method.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
7. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
8. Implement Dijkstra's algorithm for Single source shortest path problem.
9. Implement Johnson's algorithm for all pairs shortest path.
10. Compute product of two matrices using Strassen Multiplication algorithm.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- understand the logic and program for the shortest path using various algorithms.
- program for graph and do the computation.
- implement good program design to apply data abstraction.

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3
CO4	3	3	1	3	-	-	1	-	3	-	1	3	3	3

PCE19204 WEB ANALYTICS AND DEVELOPMENT LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- understand the fundamental study of web analytic tools.
- know implementation of collection, reporting, and analysis of website data.
- focus on identifying measures using data analytics.

LIST OF EXPERIMENTS

1. Study of Web Analytic Tools – Web Scaping with beautifulSoup, Web Scraping using Python & Scrapy
2. Implementation of information visualization in social network using Web Scraping
3. Implementing Web Scraping in Python with Beautiful Soup retrieval of data from the network
4. Study on A/B testing of a Webpage
5. Implementation of Data Scraping for SEO
6. Implementing web scraping using lxml in Python
7. Implementation Ranking Algorithms – Page Rank
8. Implementation of web search and retrival using web scraping

TOTAL PERIODS 60

COURSE OUTCOMES

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

- understand the various web analytic tools.
- gain practical knowledge on collection, reporting, and analysis of website data.
- analyze of the payload and data rate.

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3
CO4	3	3	1	3	-	-	1	-	3	-	1	3	3	3

PCE19205 **MINI PROJECT** **0 0 4 2**

COURSE OUTCOMES

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

- formulate a real world problem, identify the requirement and develop design solutions.
- identify technical ideas, strategies and methodologies.
- utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- test and validate through conformance of the developed prototype and analysis the cost effectiveness.
- prepare report and present oral demonstrations.

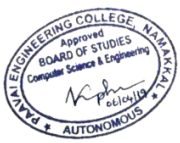
GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of 7th semester
3. The group has to identify and select the problemto be addressed as their project work; make through literature survey and finalize a comprehensive aim and scope of their work to be done
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS 60

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3
CO4	3	3	1	3	-	-	1	-	3	-	1	3	3	3



PROFESSIONAL ELECTIVE I

PCE19151 DATA PREPARATION AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn about basics of data parsing and transformation.
- understand distribution techniques.
- perform exploratory data table preparation.
- develop data visualization and to perform clustering.
- describe regression and classification techniques.

UNIT I INTRODUCTION 9

Overview- sources of data - Process for making sense of data- Defining data analysis-Data Exploration, data preparation, getting the data basic preparation - Sampling, Variability and Confidence, Handling non-numerical variables.

UNIT II DESCRIBING DATA 9

Observations and variables - types of variables - Central tendency - Distribution of data - Confidence intervals- Hypothesis tests.

UNIT III PREPARING DATA TABLES 9

Cleaning the data - Removing observations and variables, Generating consistent scales across variables, new frequency distribution - Converting text to numbers, Converting continuous data to categories – combining variables - Generating groups- Preparing unstructured data.

UNIT IV UNDERSTANDING RELATIONSHIPS AND GROUPS 9

Visualizing relationships between variables - Calculating metrics about relationships - Clustering Association rules - Learning decision trees from data.

UNIT V BUILDING MODELS FROM DATA 9

Linear regression - Logistic regression - k Nearest Neighbors - Classification and regression trees.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- learn about basics of data parsing and transformation.
- understand distribution techniques.
- perform exploratory data table preparation.

- develop data visualization and to perform clustering.
- describe regression and classification techniques.

TEXTBOOKS

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt, 2014.

REFERENCES

1. The visual display of Quantitative information, by Edward R.Tufte, 2001.
2. Visualizing data: Exploring and explaining data with the processing environment, by Ben Fry, O'Reilly Media; 1 edition (January 11, 2008).

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19152 **SECURE CODING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basics of secure programming.
- understand the most frequent programming errors leading to software vulnerabilities.
- identify and analyze security problems in software.
- understand and protect against security threats and software vulnerabilities.
- effectively apply their knowledge to the construction of secure software systems.

UNIT I INTRODUCTION **9**

Introduction to software security, Managing software security risk, Selecting software development technologies, An open source and closed source, Guiding principles for software security, Auditing software, Buffet overflows, Access control, Race conditions, Input validation, Password authentication. **Attacks:** Anti-tampering, Protecting against denial of service attack, Copy protection schemes, Client-side security, Database security, Applied cryptography, Randomness and determinism.

UNIT II SOFTWARE SECURITY **9**

Buffer Overrun, Format String Problems, Integer Overflow, and Software Security Fundamentals SQL Injection, Command Injection, Failure to Handle Errors, and Security Touchpoints.

UNIT III CROSS SITE SCRIPTING **9**

Cross Site Scripting, Magic URLs, Weak Passwords, Failing to Protect Data, Weak random numbers, improper use of cryptograph.

UNIT IV INFORMATION LEAKAGE **9**

Information Leakage, Race Conditions, Poor usability, Failing to protect network traffic, improper use of PKI, trusting network name resolution.

UNIT V CASE STUDY **9**

Case study of Cross Site Scripting, Magic URLs, Weak Passwords Buffet overflows, Access control, race conditions.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basics of secure programming
- understand the most frequent programming errors leading to software vulnerability and its security

- identify and analyze software security fundamentals, sql injections, failure to handle the errors and security touch points
- understand the cross site scripting, weak password and improper use of cryptography
- analyze the knowledge of information leakage and trusting network name resolution

REFERENCES

1. J. Viega, M. Messier. Secure Programming Cookbook, O'Reilly.
2. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft
3. J. Viega, G. McGraw. Building Secure Software, Addison Wesley

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19153 INTRODUCTION TO INTELLIGENT SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- provide a strong foundation of fundamental concepts in Artificial Intelligence
- provide a various search strategies to solve a problem
- illustrate the concept of informed search and how decisions can taken while playing a game
- represent the knowledge and reasoning in solving real time applications
- understand basic concept of knowledge base.

UNIT I INTRODUCTION 9

Introduction : What is AI?-Foundation of Artificial Intelligence- Intelligent Agents : Agents and Environments - Good Behavior – The Nature of Environments – Structure of Intelligent Agents, Goal based agents, Utility based agents –Environments :Properties of environments, Environment programs.

UNIT II PROBLEM SOLVING BY SEARCHING 9

Problem Solving Agents-Formulating Problems-Example problems-Searching for solutions- Search Strategies: Breadth first search, Uniform cost search, Depth first Search, Depth limited search, Iterative deepening search, Bidirectional search, Comparing search strategies- Constraint satisfaction search.

UNIT III INFORMED SEARCH METHODS AND GAME PLAYING 9

Best First Search: Greedy search, A* search – Heuristic functions – Iterative Improvement Algorithm: Hill climbing search, Simulated annealing- Game Playing: Introduction-Perfect Decisions in two person games- Imperfect decisions-Alpha Beta Pruning.

UNIT IV KNOWLEDGE REPRESENTAITON AND REASONING 9

A Knowledge based agent-Representation, Reasoning and Logic – Propositional Logic - First Order Logic: Syntax and Semantics- Extensions and notational variations- Using First Order logic.

UNIT V KNOWLEDGE BASE 9

Properties of Good and Bad Knowledge base- Knowledge Engineering-General Ontology- Inference in First Order Logic: Inference rules involving quantifiers -Generalized Modus Ponens-forward and Backward chaining – Completeness – Resolution- Logical Reasoning system: Introduction – Indexing, Retrieval and Unification – Logic Programming systems.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- illustrate the key aspects of the artificial intelligence, intelligent agents
- apply search strategies to solve a problem

- identify the best searching methodologies and identify methods to play game.
- represent, reasoning and logic towards knowledge based agent
- identify the good and bad knowledge base

TEXT BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Education / Prentice Hall of India, 2010.

REFERENCES

1. Nils J Nilsson, "Artificial Intelligence: A New Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Second Edition, Tata McGraw-Hill, 2003.
3. George F Luger, "Artificial Intelligence - Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19154 **PATTERN RECOGNITION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand linear programming problems.
- learn unsupervised classification through clustering.
- know the underlying concepts of grammars of pattern.
- estimate feature extraction and selection.
- get to know the advancements in pattern recognition.

UNIT I PATTERN CLASSIFIER **10**

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION **8**

Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

UNIT III STRUCTURAL PATTERN RECOGNITION **9**

Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation

UNIT IV FEATURE EXTRACTION AND SELECTION **9**

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

UNIT V RECENT ADVANCES **9**

Neural network structures for Pattern Recognition – Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the classification using Supervised learning.
- analyze the difference between supervised and unsupervised methods

- understand pattern recognition
- know the extraction and selection of clustering.
- understand the clustering in neural networks

REFERENCES

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PROFESSIONAL ELECTIVE-II

PCE19251 **STORAGE AREA NETWORK** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about information availability and business continuity.
- understand the backup/recovery topologies.
- know the local replication and remote replication technologies and their operation.
- understand processes and technologies for identifying, analyzing, and mitigating security risks in storage infrastructure.
- students will demonstrate effective oral and writing communication skills necessary to be effective and to compete at global business environment.

UNIT I INTRODUCTION 9

Introduction to Storage Technology Information storage, evolution of storage technology and architecture, data center infrastructure, key challenges in Managing information, information lifecycle. Storage system Environments: components of storage system environment, Disk Drive components, Disk Drive Performance, fundamental laws governing disk performance, logical components of the host, application requirements and disk performance.

UNIT II PROTECTION 9

Data Protection: RAID: Implementation of RAID, RAID array components, RAID levels, RAID comparison, RAID Impact on disk performance, host spares. Intelligent Storage System: Components of an Intelligent Storage System, Intelligent Storage array, concepts in Practice: EMC CLARIION and Symmetric.

UNIT III STORAGE 9

Direct – Attached Storage and Introduction to SCSI: Types of DAS, DAS benefits and limitations, disk drive interfaces, introduction to parallel SCSI, SCSI command model. Storage Area Networks: fibre channel, The SAN and Its evolution, components of SAN, FC connectivity, Fibre channel ports, fibre channel architecture, zoning, fiber channel login types, concepts in practice: EMC Connectrix.

UNIT IV NETWORK ATTACHED STORAGE 9

Network attached storage: general purpose servers vs NAS Devices, benefits of NAS, NAS file I/O, components of NAS, NAS Implementations, NAS file sharing protocols, NAS I/O operations, factors effecting NAS Performance and availability, concepts in practice: EMC Celerra.IP SAN: iscsi, fcip. Content – addressed storage: Fixed content and Archives, types of archives, features and benefits of CAS, CAS Architecture, object storage and retrieval in CAS, CAS Examples, concepts in practice: EMC Centera

UNIT V STORAGE VIRTUALIZATION 9

Storage Virtualization: Formas of Virtualization, SNIA Storage virtualization taxonomy, storage virtualization configurations, storage virtualization challenges, types of storage virtualization, concepts in practice: EMC Invista, Rainifinity. Introduction to business continuity: information availability, BC terminology, BC planning life cycle, Failure analysis, business impact analysis, BC technology solutions, concepts in practice: EMC Power path. Backup and recovery: backup purpose, backup considerations, backup granularity, recovery considerations, backup methods, backup process, backup and restore operations , backup topologies, backup in NAS environments, backup technologies, concepts in practice: EMC Networker, EMC Disk Library(EDL).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the storage technology information in business.
- know the concepts of RAID and implementation.
- know the disk interfaces like SCSI with storage.
- understand the network attached storage.
- implementation of virtualization in storage.

TEXT BOOKS

1. G. Somasundaram, A. Shrivastava, EMC Corporation: Information Storage and Management, 1st Edition, wiley publishing, 2009.
2. Robert Spalding, Storage Networks: The Complete Reference, 1st Edition, TMH, 2003.

REFERENCES

1. Marc Farley: Building Storage Networks, 2nd Edition, Tata McGraw Hill, Osborne, 2001.
2. Meeta Gupta: Storage Area Network Fundamentals, 2nd Edition, Pearson Education Limited, 2002.

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19252 **DATA STORAGE TECHNOLOGIES AND NETWORK** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about storage media techniques.
- understand the medium of access and memory hierarchy.
- know the different types of storage.
- gain knowledge of the storage architecture.
- understand the hardware and software components of storage area network.

UNIT I INTRODUCTION **9**

Storage Media and Technologies – Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.

UNIT II USAGE AND ACCESS **9**

Usage and Access – Positioning in the Memory Hierarchy, Hardware and Software Design for Access, Performance issues.

UNIT III STORAGE **9**

Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, Networking issues.

UNIT IV ARCHITECTURE **9**

Storage Architecture - Storage Partitioning, Storage System Design, Caching, Legacy Systems.

UNIT V NETWORKS **9**

Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS-Performance, Reliability, and Security issues.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge about the fundamentals of storage media techniques.
- understand how to access the storage medium and its memory hierarchy.
- know different type of storage.
- understand the architecture of storage.
- understand the components of SAN.

TEXT BOOKS

1. The Complete Guide to Data Storage Technologies for Network-centric Computing Paperback– Import, Mar 1998 by Computer Technology Research Corporation.
2. Data Storage Networking: Real World Skills for the CompTIA Storage by Nigel Poulton.

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19253 **ETHICAL HACKING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduces the concepts of Ethical Hacking and gives the students the opportunity
- learn about different tools and techniques in Ethical hacking
- know the security and practically apply some of the tools.
- learn the client side exploitation.
- analyse the threats of hacking.

UNIT I INTRODUCTION TO ETHICAL DISCLOSURE **9**

Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure.

UNIT II PENETRATION TESTING AND TOOL **9**

Using Metasploit, Using Back Track Live CD Linux Distribution

UNIT III VULNERABILITY ANALYSIS **9**

Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering

UNIT IV CLIENT-SIDE BROWSER EXPLOITS **9**

Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit.

UNIT V MALWARE ANALYSIS **9**

Collecting Malware and Initial Analysis, Hacking Malware

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basic ethics of ethical hacking
- understand the ethical testing and their tools
- identify and analyze vulnerabilities and advance reverse engineering
- understand the client-side browser and their vulnerability
- analyze the knowledge of malware

REFERENCES

1. Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez
2. Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill.

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19254 DATA VIRTUALIZATION TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the various basic fundamentals of data virtualization techniques.
- gain the knowledge on server virtualization and logical partitioning.
- study different network virtualization concepts.
- get the knowledge on storage based architecture, backup and recovery techniques.
- work with Microsoft virtual server and various virtual machine products.

UNIT I OVERVIEW OF VIRTUALIZATION 9

Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization-Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines.

UNIT II SERVER CONSOLIDATION 9

Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization –Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform.

UNIT III NETWORK VIRTUALIZATION 9

Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – Ipsec L2TPv3 Label Switched Paths.

UNIT IV VIRTUALIZING STORAGE 9

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN.

UNIT V VIRTUAL MACHINES PRODUCTS 9

Xen Virtual machine monitors- Xen API – VMware – VMware products – Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand about computing virtualization tools, applications and techniques
- able to understand server virtualization and virtualization platform
- understand the technologies of virtualization and network virtualization
- understand the concepts of virtualization storage
- study the virtual machine products

REFERENCES

1. William von Hagen, Professional Xen Virtualization, WroxPublications, January, 2008.
2. Chris Wolf, Erick M. Halter, and Virtualization: From the Desktop to the Enterprise, APress 2005.
3. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.
4. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
5. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.

PROFESSIONAL ELECTIVE-III

PCE19351 KNOWLEDGE DISCOVERY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain the basic concepts of data mining and machine learning.
- learn representation of knowledge through various methods.
- know about decision tress for prediction.
- learning to write classification rules.
- know how to make predictions with classification.

UNIT I INTRODUCTION **9**

Introduction to KDD and Data Mining - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics.

UNIT II KNOWLEDGE REPRESENTATION **9**

Knowledge Representation - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters.

UNIT III DECISION TREES **9**

Decision Trees - Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation.

UNIT IV RULES **9**

Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency.

UNIT V PREDICTION **9**

Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees, Evaluating Numeric Predictions.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the underlying concepts of datamining and machine learning.
- represent the knowledge through various techniques.
- do predictor through decision making.

- write classification rules.
- Prediction through classification rules.

REFERENCES

1. Data mining and knowledge discovery handbook by Maimon, oded(et al.)
2. Data Cleansing : A Prelude to knowledge Discovery

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19352 **SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- fix software flaws and bugs in various software.
- learn various methodologies of software applications and development.
- implement and support network services on an enterprise scale.
- be familiar with the concepts of cryptography and software security.
- design and develop secured software with minimum vulnerabilities and flaws.

UNIT I SECURE SOFTWARE DESIGN **9**

Defining computer security - Principles of secure software, Trusted computing base, Threat modeling, Advanced techniques for mapping security requirements - Secure software design - Deployment and ongoing management.

UNIT II ENTERPRISE APPLICATION DEVELOPMENT **9**

Enterprise software applications - Design distributed N-tier software application, business and data tiers of an enterprise software application, design and build a database using an enterprise database system – develop components at the different tiers in an enterprise system - design and develop a multi-tier solution to a problem

UNIT III ENTERPRISE SYSTEMS ADMINISTRATION **9**

Design - Implement and maintain a directory-based server infrastructure, monitor server resource utilization- Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT IV SOFTWARE SECURITY IN ENTERPRISE BUSINESS **9**

Software Security in Enterprise Business: Identification and authentication - Enterprise Information Security - Symmetric and asymmetric cryptography - Public key cryptography - Data Encryption Standard (DES) - Advanced Encryption Standard (AES) - Algorithms for hashes and message digests.

UNIT V SECURITY DEVELOPMENT FRAMEWORKS **9**

Security development frameworks: Security issues of information systems - Internet-based e-commerce, e-business and e-service systems - Develop secure information systems for enterprises - Policies and Regulations of enterprise information systems.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand various aspects and principles of software security.
- identify and analyze the risks associated with s/w engineering and use relevant models to mitigate the risks.
- Interrelate security and software development process.
- understand the various security algorithms to implement for secured computing and computer networks.
- develop software security policy frameworks.

TEXT BOOKS

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett, 2012.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley, 1st Edition, 2014.

REFERENCES

1. W. Stallings, Cryptography and network security: Principles and practice, 5th Edition, Upper Saddle River, NJ: Prentice Hall., 2011.
2. C. Kaufman, r. Perlman, & M. Speciner, Network security: Private communication in a public world, 2nd Edition, Upper Saddle River, NJ:Prentice HalL, 2002.
3. C. P. Pfleeger, S. L. Pfleeger, Security in Computing, 4th Edition, Upper Saddle River, NJ:Prentice Hall, 2007.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19353 **COMPUTER VISION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- obtain the knowledge of the foundation of image formation, measurement, and analysis.
- be familiar with both the theoretical and practical aspects of computing with images.
- understand the segmentation concepts for image processing.
- learn feature extraction and analysis methods.
- grasp the principles of state-of-the-art deep neural networks.

UNIT I INTRODUCTION **9**

Overview of Computer Vision - Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera - Image Analysis.

UNIT II FEATURE DETECTION AND MATCHING **9**

Points and Patches: Feature Detectors, Feature Descriptors, Feature Matching, Feature Tracking – Edges: Edge Detection, Edge Linking, Edge Detection Performance – Lines.

UNIT III SEGMENTATION **9**

Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding Normalized Cuts, Graph Cuts and Energy Based Methods -Morphological Filtering -Fourier Transform.

UNIT IV FEATURE ANALYSIS **9**

Feature Extraction: Shape, Histogram, Color, Spectral, Texture, CVIP Tools - Feature Analysis: Feature Vectors, Distance and Similarity Measures, Data Preprocessing.

UNIT V PATTERN ANALYSIS **9**

Clustering: K-Means, K-Medoids, Mixture of Gaussians - Classification: Bayes Classifier, Decision Tree Classifier, Support Vector Machines.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain the knowledge of image formation, measurement, and analysis.
- developed the practical skills necessary to build computer vision applications.
- know the segmentation concepts for image processing.
- implement feature extraction and analysis methods.
- gain exposure to clustering and classification methods for pattern analysis.

REFERENCES

1. Richard Szeliski , "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Scott E Umbaugh,"Computer Imaging – Digital Image Analysis and processing", CRC Press book, 2005.
3. Goodfellow, Bengio, and Courville, "Deep Learning", MIT, 2016.
4. Fisher et al, "Dictionary of Computer Vision and Image processing", John Wiley & Sons, Ltd, 2005.
5. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", oreilly , 2017.
6. Mohammed J.Zaki, Wagner Meira JR, " Data Mining and Analysis Fundamental Concepts and Algorithms", Cambridge University Press, 2014.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
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CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19354 **SOFTWARE DESIGN** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the need of software design approaches and architectures.
- learn the software design methodologies and principles.
- know about the software design architectures.
- build design knowledge on user interface.
- develop appropriate architectures for various real time applications.

UNIT I INTRODUCTION **9**

Introduction to Software Architecture-Bridging Requirements and Implementation, Design Guidelines, Software. Quality attributes- The nature of Design process-Objectives-Building Modules, Constructs, Design qualities, assessing the design, Design viewpoints for software- Agile Approach to Software Architecture Design

UNIT II DESIGN METHODOLOGIES **9**

Design practices -Rational for method, Top down and bottom up design strategies, Organizational methods and design- object-oriented and object-based design and Structured System Analysis and Structured design method and principles-Software Architectures- Repository Architecture, Blackboard Architecture. Hierarchical Architecture Main-Subroutine, Master-Slave, Layered, Virtual Machine. Interaction-Oriented Software Architectures

UNIT III DESIGN MODELS **9**

Software design architecture-Distributed Architecture-fundamentals-MOM,CORBA Message Broker Architecture- Service-Oriented Architecture (SOA), SOAP, UDDI, Heterogeneous Architecture-traditional design approach- SADT,SSADM and design for real time systems-MASCOT

UNIT IV USER INTERFACE DESIGN **9**

Architecture of User Interfaces containers-Product Line Architectures - Software Reuse and Product Lines -Model Driven Architectures (MDA) –Eclipse modeling framework- Human Computer Interaction – guidelines for Interface design.

UNIT V REALTIME APPLICATIONS **9**

Aspect Oriented Architectures- AOP in UML,AOP tools, Evaluation of Architecture Designs, Real time applications and distributed applications .Case Study: Online Computer Vendor, order processing, manufacture & shipping –inventory and supply chain- cloud service management, semantic web services.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the need of software design principles and architecture.
- explain the design principles and methodologies.
- differentiate traditional design model and modern approaches.
- elaborate about the need of user interface design.
- have a sound knowledge on developing appropriate architectures through various case studies.

TEXT BOOKS:

1. Software Architecture Design Illuminated, Kai Qian Jones and Bartlett Publishers Canada, 2010.
2. David Budgen, " Software Design ", Addison-Wesley, 1994.
3. Pressman R.S, " Software Engineering ", 4th Edition, McGraw Hill Inc., 1996.
4. A.G. Suteliffe, " Human Computer Interface Design ", II Edition Macmillan 1995.

REFERENCES:

1. Essentials of software Architecture , Ion Gorton, Second Edition, Springer-verlag, 2011 .
2. Ed Downs, Peter Clare, Jan coe, " Structured System Analysis and Design methods Application and Context ", Prentice Hall, 1998.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PROFESSIONAL ELECTIVE-IV

PCE19451 HUMAN AND COMPUTER INTERACTION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic principles of Human and Computers
- acquire knowledge on navigation and usability standards of the computer
- analyze the various programming applications and evaluation methods
- learn the various models of problem solving and analysis of Task
- understand the various dialogue notations used under groupware and shared applications.

UNIT I FOUNDATIONS 9

Cognitive Principles: Human Vision, Hearing, Touch, Movement-Output channels- Human memory-STM and LTM Thinking-Reasoning and problem solving, Emotions, Individual difference (sex, physical age), psychology - Text entry devices, display devices: 3D interaction, paper, memory, processing and networks, Ergonomics, Interaction Styles - WIMP: Interactivity, Design issues: Context and experience.

UNIT II DESIGN PROCESS 7

Navigation- Screen- Screen design- Iteration and prototyping, Software life cycle- Usability - Support Usability- Standards - Guidelines- Golden rules.

UNIT III IMPLEMENTATION AND EVALUATION 9

Elements of Windowing: programming application - Toolkits, UI management systems, Goals, Expert analysis-user Participation - Evaluation methods - Universal Design, User support.

UNIT IV MODELS AND TASK ANALYSIS 9

Cognitive Models, GOMS, linguistic, physical and device models - Socio-organizational issues :power and organizational structure, free rider problem, Critical mass, invisible workers, stakeholder requirements - Communication and collaboration models - Ethnography, face to face communication, gesture, body language-back channels-Conversations - Task analysis, task decomposition, knowledge based technique.

UNIT V THEORIES AND GROUPWARE 11

Dialogue notations: STN, H-STN, JSD, Petri net, state charts, flow charts , Concurrent dialogues : Modelling rich interaction-status event analysis-rich set behavior- properties of events - Groupware : definition, time/space matrix, computer mediated communication (email, BB, structured text message, video, virtual environment) – Meeting and Decision support systems (argumentation tools, meeting rooms, shared work surfaces) - Shared application (shared PCs and windows, shared editors, co-authoring tools, shared diaries)

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basic hci concepts and various design process, standards and guidelines
- perform implementation support and evaluation of process design
- develop various models and task analysis
- implement various models of problem solving.
- apply various dialogue notations, groupware and shared applications

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory D. Abowd and Russel Beale, "Human Computer Interaction", 3rd Edition, 2004, Pearson Education, ISBN: 978-0130461094.

REFERENCES

1. K.Meena and R.Sivakumar, "Human-Computer Interaction", 2015, Prentice Hall India.
2. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, 2009, Pearson Addison-Wesley.
3. Yvonne Rogers, Heken Sharp and Jenny Preece, "Interaction Design: Beyond Human-Computer Interaction", 3rd Edition, 2011, John Wiley & Sons, Inc.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19452 **GPU COMPUTING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- learn concepts in parallel programming
- be familiar with memory allocation
- learn and implement programs for concurrent data structures
- able to debug and execute GPU program
- be familiar with real time applications with case study.

UNIT I INTRODUCTION **9**

History: Heterogeneous Parallel Computing, Architecture of a Modern GPU - Graphics Processors-Graphics Processing Units-GPGPUs- Clock speeds, CPU / GPU comparisons, Heterogeneity- Accelerators-Parallel programming: CUDA OpenCL / OpenACC -Hello World – Computation : Kernels- Launch parameters- Thread hierarchy-Warps / Wave fronts- Thread blocks / Workgroups- Streaming multiprocessors- 1D / 2D / 3D thread mapping - Device properties- Simple Programs.

UNIT II MEMORY **9**

Memory hierarchy-DRAM / global- local / shared- private / local- textures- Constant Memory- Pointers-Parameter Passing- Arrays and dynamic Memory- Multi-dimensional Arrays- Memory Allocation- Memory copying across Devices- Programs with matrices- Performance valuation with different memories.

UNIT III SYNCHRONIZATION **9**

Memory Consistency- Barriers (local versus global), Atomics- Memory fence. Prefix sum- Reduction.-Programs for concurrent data structures : worklists, linked-lists- Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

UNIT IV SUPPORT AND STREAMS **9**

Support: Debugging GPU Programs-Profiling-Profile tools- Performance aspects-Streams: kernel Asynchronous Processing - tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams- Events- Event-based- Synchronization - Overlapping data transfer and execution, pitfalls

UNIT V CASE STUDY **9**

Image processing- Graph algorithms-Simulations- Deep learning.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- remember concepts in parallel programming
- understand memory allocation concepts
- analyze and Implement programs for concurrent data structures
- apply synchronization functions in GPU programs
- implement algorithms real time applications.

REFERENCES

1. David Kirk, Wen-mei Hwu; Morgan Kaufman "Programming Massively Parallel Processors: A Hands-on Approach" ;2010 (ISBN: 978-0123814722)
2. Shane Cook ; Morgan; Kaufman "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs" 2012 (ISBN: 978-0124159334)
3. B. Gaster, L. Howes, D. Kaeli, P. Mistry, D. Schaa, Morgan Kaufmann "Heterogeneous Computing with OpenCL", 1st Edition, August 31, 2011
4. R. Fernando and M. Kilgard, "The Cg Tutorial: The Definitive Guide to Programmable Real-Time Graphics", Addison-Wesley, 2003.
5. Nicholas Wilt " The CUDA Handbook A Comprehensive Guide to GPU Programming ", Addison-Wesley, 2013

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PCE19453 **DIGITAL FORENSICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- learn digital forensics fundamentals.
- know about evidence collection on a threat.
- understand the procedures to uncover hidden information in digital systems, documenting the investigation.
- explore forensics in web, email, network layers, cloud, and mobile devices.
- understand and learn about the business of digital forensics.

UNIT I ANATOMY OF DIGITAL INVESTIGATIONS 9

Digital Forensics Fundamentals: What is ForensWeb ics -understanding the scope of investigation-the art of documentation -the laws affecting forensic investigation- constitutional implications of forensic investigation—the right to privacy-the expert witness-popular myths about computer forensics, its importance-types of forensic evidence recovered-skills to be possessed by a computer forensic investigator.

UNIT II EVIDENCE COLLECTION AND DATA SEIZURE 9

Search warrants-what is a search and when it is legal-the warrantless search-legislated. privacy concerns-general privacy -privacy in healthcare and education-privileged information-the admissibility of evidence-the first response and the digital investigator- forensics and controlling the scene of the crime-handling evidence-acquiring evidence in computer Forensics lab: Lab requirements-private sector forensic lab-extracting evidence from a device.

UNIT III DATA ACQUISITION, ANALYSIS, DOCUMENTING THE INVESTIGATION 9

Data acquisition-memory and running process-acquiring media-finding lost files: file recovery-the deleted file – data carving-document analysis; file identification-understanding metadata-mining the temporary files-identifying the alternate places of hiding data-online investigations: working undercover-website evidence-background searches-online crime-capturing online communications, Documenting: Obtaining evidence-seizing evidence-documenting the evidence- Using tools -writing reports-using expert witnesses at trial-admissibility of digital evidence.

UNIT IV TOOLS-FORENSICS IN EMAIL, WEB, NETWORKS, CLOUD, MOBILE DEVICES. 9

Email: Email technology-information stores-the anatomy of an email-an approach to email analysis, Web: Internet addresses-web browsers-web servers, proxy servers, DHCP servers ,SMTP servers, DNS servers, routers ,IDS, Firewalls, ports, Networks: Searching the network- an eagle’s eye view-initial response-understanding the OSI model- advanced persistent threats-investigating a network attack-proactive collection of evidence-post incident collection of evidence-router and switch forensics, Excavating a cloud: What is

cloud -cloud computing-shaping the cloud-the Implications of cloud forensics-on virtualization-constitutional issues, mobile device forensics: Challenges of a mobile device forensics-how a cell phone works-data storage on cell phones-SIM card forensics-types of evidence-handset forensics-standard operating procedures for handling a handset evidence-acquisition and storage –legal aspects of mobile device forensics-photograph forensics-Mac forensics.

UNIT V FORENSIC WORKSTATION AND BUSINESS OF DIGITAL FORENSICS 9

What is a forensic workstation?-building a forensic workstation from scratch-licensing and certification: digital forensic certification-vendor neutral certification programs—vendor specific certification program-digital forensic Licensing requirements-starting and maintaining a forensic organization, generating revenue, organizational Certification.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the digital investigation and find the evidence for the given problem.
- gain knowledge in collecting the evidences.
- analyze and document an investigation.
- gain information on various digital forensics.
- acquire information about building a career on digital forensics.

TEXT BOOKS

1. Michael Graves,-Digital Archaeology: The Art and Science of Digital Forensics‖, AddisonWesley Professional, 2014.
2. Darren R. Hayes,-Practical Guide to Computer Forensics Investigation‖, Pearson, 2015.
3. Albert J. Marcella and Frederic Guillossou,-Cyber Forensics: From Data to Digital Evidence-, Wiley, 2015.

REFERENCES

1. Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011.

2. Angus M.Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008.

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2

PCE19454 **ADVANCED WIRELESS AND MOBILE NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- get familiar with the wireless/mobile market and the future needs and challenges.
- get familiar with key concepts of wireless networks, standards, technologies and their basic operations
- learn how to design and analyse various medium access
- learn how to evaluate MAC and network protocols using network simulation software tools.
- get familiar with the security challenges in wireless and mobile networks.

UNIT I INTRODUCTION **9**

Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies – CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

UNIT II WIRELESS CELLULAR NETWORKS: **9**

1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT III WIRELESS SENSOR NETWORKS **9**

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

UNIT IV WIRELESS PANs **9**

Bluetooth AND Zigbee, Introduction to Wireless Sensors.

UNIT V SECURITY **9**

Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand various types of wireless networks, standards, operations and use cases.
- design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance

analysis

- demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
- understand the latest wireless technologies.
- aware of the security challenges in wireless networks..

REFERENCES

1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
3. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
4. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

SEMESTER III

PCE16301 SOFTWARE ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

- To understand the architectural requirements
- To identify the architectural structures.
- To develop the architectural documentation.
- To generate the architectural alternatives.
- To evaluate the architecture against the drivers.

UNIT I ARCHITECTURAL DRIVERS 9

Introduction – Standard Definitions of Software Architecture– Architectural structures – Influence of software architecture on organization – Architecture Business Cycle – Functional requirements – Technical constraints Quality Attributes – Quality Attribute Workshop (QAW) – Documenting Quality Attributes – Six part scenarios.

UNIT II ARCHITECTURAL VIEWS AND DOCUMENTATION 9

Introduction – Standard Definitions for views – Structures and views- Perspectives: Static, dynamic and physical and the accompanying views – Representing views-available notations – Good practices in documentation– Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages Architectural Description Languages – ACME.

UNIT III ARCHITECTURAL STYLES 9

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT IV ARCHITECTURAL DESIGN 9

Approaches for architectural design – System decomposition – Attributes driven for specific quality design – Architecting attributes – Performance, Availability – Security – Architectural conformance.

UNIT V ARCHITECTURE EVALUATION AND SOME SPECIAL TOPICS 9

Need for evaluation – Scenario based evaluation against the drivers – ATAM and its variations – Case studies in architectural evaluations – SOA and Web services – Cloud Computing – Adaptive structure

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the key architectural drivers and the influence of architecture on business and technical activities.
- adopt good practices for documenting the architecture.
- develop alternative architectures for a given problem.
- use formal languages to specify architecture
- describe the recent trends in software architecture.

TEXT BOOKS

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, Auerbach Publications, 2010.

REFERENCES

1. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010.
2. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and case studies.” Addison-Wesley, 2001.
3. RajkumarBuyya, James Bromberg, and AndrzejGoscinski, “Cloud Computing. Principles and Paradigms”, John Wiley & Sons, 2011.

WEB LINKS

1. https://www.tutorialspoint.com
2. https://www.cs.cmu.edu/afs/cs/project/tinker-arch
3. https://www.codementor.io

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16302 NETWORK AND INFORMATION SECURITY 3 0 0 3

COURSE OBJECTIVES

- To familiarize the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity
- To realize the various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To design security applications in the field of Information technology.

UNIT I INTRODUCTION 9

An Overview of Computer Security- Security Services- Security Mechanisms-Security Attacks- Access Control Matrix, Policy- Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT II CRYPTOSYSTEMS &AUTHENTICATION 9

Classical Cryptography-Substitution Ciphers - permutation Ciphers - Block Ciphers - DES - Modes of Operation - AES - Linear Crypt analysis, Differential Cryptanalysis - Hash Function - SHA512 – Message Authentication Codes - HMAC - Authentication Protocols.

UNIT III PUBLIC KEY CRYPTOSYSTEMS **9**

Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer- Attacks on RSA -The ELGamal Cryptosystem- Digital Signature Algorithm-Finite Fields- Elliptic Curves Cryptography-Key management- Session and Interchange keys ,Key exchange and generation-PKI

UNIT IV SYSTEM IMPLEMENTATION 9

Design Principles, Representing Identity, Access Control Mechanisms ,Information Flow and Confinement Problem - Secure Software Development: Secured Coding - OWASP/SANS Top Vulnerabilities – Buffer Overflows- Incomplete mediation - XSS - Anti Cross Site Scripting Libraries- - Canonical Data Format - Command Injection-Redirection-Inference-Application Controls

UNIT V NETWORK SECURITY 9

Secret Sharing Schemes-Kerberos- Pretty Good Privacy(PGP)-Secure Socket Layer(SSL)- Intruders- HIDS-NIDS-Firewalls-Viruses.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- estimate the performance and throughput of a given network
- design a network aimed at optimum performance
- identify and analyses security problems in networks.
- apply appropriate security techniques to solve security problems
- understand the legal, copyright and privacy issues.

TEXT BOOKS

1. Menezes Bernard, "Network Security and Cryptography", Cengage Learning, New Delhi,2011
2. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.

REFERENCES

1. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education,2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R.Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC,2006

WEBLINKS

1. www.youlinux.com
2. http://xml.coverpages.org/OWASP-TopTen.pdf

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE III

PCE16351 **INTERNET OF THINGS** **3 0 0 3**

COURSE OBJECTIVES

- To identify and design the new models for market strategic interaction.
- To develop business intelligence and information security for Internet of Things (IoT).
- To compare various protocols for IoT.
- To develop a middleware for IoT.
- To develop different models for network dynamics.

UNIT I INTRODUCTION **9**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information. Security.

UNIT II IOT PROTOCOLS **9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols- Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus-KNX – Zigbee Architecture – Network layer – APS layer – Security.

UNIT III WEB OF THINGS **9**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT IV INTEGRATED **9**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things – Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behaviour in Networks - The Small-World Phenomenon

UNIT V APPLICATIONS **9**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify and design the new models for market strategic interaction
- design business intelligence and information security for web
- analyses various protocols for IOT
- design a middleware for IOT

- analyses and design different models for network dynamics

TEXT BOOKS

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.) – Springer- 2011

REFERENCES

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010
2. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

WEBLINKS

1. https://www.linkedin.com/pulse/web-links-projects-iot-varsity
2. https://www.peterindia.net/TheInternetofThings.html

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16352 **REALTIME SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

- To provide good understanding of fundamental concepts in real time systems..
- To realize the advanced topics and areas in real time systems
- To understand the basic multi-task scheduling algorithms for periodic and sporadic tasks as well as understand the impact of the latter woon scheduling.
- To expose the capabilities of commercial off-the-shelf R-T kernel
- To expose to real time communications and databases.

UNIT I INTRODUCTION **9**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT II REAL TIME SCHEDULING **9**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective- Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT III RESOURCES SHARING **9**

Effect of Resource Contention and Resource Access Control (RAC), Non-pre-emptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority - Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT IV REAL TIME COMMUNICATION **9**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT V REAL TIME OPERATING SYSTEMS AND DATABASE **9**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the basics and importance of real-time systems.
- create a high-level analysis document based on requirements specifications
- make a high-level design document based on analysis documentation
- generate the test and validation plan based on requirements specification based on documentation
- understand capabilities of at least one commercial off-the-shelf r-t kernel.

TEXT BOOKS

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.

REFERENCES

1. Mall Rajib, "Real Time Systems", Pearson Education.
2. Albert M. K. Cheng, "Real-Time Systems: Scheduling, Analysis, and Verification", Wiley.

WEBLINKS

1. http://www.realtime-info.be/
2. http://www.eg3.com/navi/real.html
3. http://www.realtime-info.be/encyc/techno/publi/faq/rtos_faq_table.html

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16353 **COMPUTER VISION** **3 0 0 3**

COURSE OBJECTIVES

- To review image processing techniques for computer vision
- To be aware of shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To realize three-dimensional image analysis techniques
- To recognize motion analysis for 3 dimensional objects

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 labelling and counting -size filtering - distance functions – skeleton 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 offices Application: Surveillance -fore ground-back ground 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 PERIODS 45

COURSE OUTCOMES

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

- put into practice fundamental image processing techniques required for computer vision
- perform shape and region analysis
- realize boundary tracking techniques
- apply 3d vision techniques
- implement motion related techniques and develop applications using computer vision techniques

REFERENCES

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

WEB LINKS

1. http://nptel.ac.in/courses/106105032/
2. http://nptel.ac.in/courses/117105079/
3. http://www.nptelvideos.in/2012/12/digital-image-processing.html

Mapping of Course Outcomes with Programming Outcomes
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16354 **RESEARCH METHODOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To develop a hypothesis, a research problem and related questions.
- To frame the problem with the correct research methodology.
- To collect data that accurately addresses the research problem.
- To use data to make decisions.
- To evaluating feasibility of research proposals.

UNIT I INTRODUCTION **9**

The nature of CS research - what is research? - Project planning, tools and techniques for planning – Literature searches, information gathering.

UNIT II PROJECT DEVELOPMENT **9**

Reading and understanding research papers - Project implementation and IT project management. – Presentation skills, written and oral - Time management- Team working.

UNIT III OPTIMIZATION METHODS **9**

Linear Programming: Simplex method – Dynamic Programming – Integer Programming - Hill climbing.

UNIT IV 3D VISION AND MOTION **9**

Simulated annealing - Quantum annealing - Genetic algorithms - Ant colony optimization - Particle swarm optimization - Tabu search - Beam search.

UNIT V APPLICATIONS **9**

Commercial and economic considerations in the IT industry - Review of Legal, Ethical, Social and Professional (LSEP) issues, such as data protection, hacking, etc. - Technical writing, referencing, bibliographies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- prepare a preliminary research design for projects in their subject matter areas .
- accurately collect, analyze and report data .
- present complex data or situations clearly.
- produce optimized project outcome.
- review and analyze research findings that affect their agency.

REFERENCES

1. C. W. Dawson, The Essence of Computer Projects: A Student Guide. New Delhi: PHI, 2006.
2. Duane A. Bailey, A Letter to Research Students. Massachusetts.
3. Humdy Taha, Operation Research. New Delhi: PHI, 2007.
4. S. Kirkpatrick and C. D. Gelatt and M. P. Vecchi. Optimization by Simulated Annealing, Science, Vol 220, 1983, 671-680.
5. B. Apolloni, N. Caravalho and D. De Falco. Quantum stochastic optimization, Stochastic Processes and their Applications, Vol. 33, 1989, 233-244.

6. David E. Goldberg. Genetic Algorithms in Search, Optimization, and Machine Learning, New Delhi : New Age, 1989.

WEB LINKS

1. http://nptel.ac.in/courses/107108011/
2. http://nptel.ac.in/syllabus/107108011/
3. http://www.nptel.ac.in/syllabus/121106001/

Mapping of Course Outcomes with Programming Outcomes
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16355 DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

- To learn various models of parallel algorithms
- To understand the performance of parallel computation
- To expose the students to parallel sorting and merging algorithms
- To understand the various concept of parallel searching algorithm
- To analyse parallel algorithms

UNIT I INTRODUCTION 9

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II PERFORMANCE MEASURES OF PARALLEL ALGORITHMS 9

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III PARALLEL SORTING NETWORKS 9

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks on CREW/EREW/MCC/, linear array.

UNIT IV PARALLEL SEARCHING ALGORITHM 9

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V PARALLEL GRAPH ALGORITHM 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the need for parallel algorithms
- discuss the classification of parallel architectures and identify suitable programming models
- perform sorting on CREW, EREW models
- implement optimized searching and sorting algorithms
- apply parallel graph algorithms to find real time solutions

REFERENCES

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms”.
3. Jaja, “Introduction to Parallel algorithms”, Pearson, 1992.
4. S.G. Akl,”Parallel Sorting Algorithm” by Academic Press.

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1. http://nptel.ac.in/courses/106106112/
2. http://nptel.ac.in/syllabus/106106112/
3. http://nptel.ac.in/courses/106104120/Assignment.pdf

Mapping of Course Outcomes with Programming Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE IV

PCE16451 MODEL CHECKING AND PROGRAM VERIFICATION 3 0 0 3

COURSE OBJECTIVES

- To understand automata model
- To analyse LTL, CTL, and CTL*
- To understand timed automata, TCTL, and PCTL
- To analyse verification of deterministic and recursive programs
- To expose verification of object-oriented programs, parallel, distributed, and non-deterministic programs

UNIT I AUTOMATA AND TEMPORAL LOGICS 9

Automata on finite words-model checking regular properties-automata on infinite words- Buchi automata – Linear Temporal Logic (LTL) - automata based LTL model checking - Computational Tree Logic (CTL) - CTL model Checking - CTL*model checking.

UNIT II TIMED AND PROBABILISTIC TREELOGICS 9

Timed automata - timed computational tree logic (TCTL) - TCTL model checking - probabilistic systems - Probabilistic computational tree logic (PCTL) - PCTL model checking - PCTL*- Markov decision processes.

UNIT III VERIFYING DETERMINISTIC AND RECURSIVE PROGRAMS 9

Introduction to program verification -verification of "while" programs -partial and total correctness – verification of recursive programs -case study: binary search -verifying recursive programs with parameters.

UNIT IV VERIFYING OBJECT-ORIENTED AND PARALLEL PROGRAMS 9

Partial and total correctness of object - oriented programs - case study: Insertion in linked lists - verification of disjoint parallel programs -verifying programs with shared variables- case study: parallel zero search-verification of synchronization -case study: the mutual exclusion problem.

UNIT V VERIFYING NON-DETERMINISTIC AND DISTRIBUTED PROGRAMS 9

Introduction to non-deterministic programs - partial and total correctness of non- deterministic programs- case study: The Welfare Crook Problem- syntax and semantics of distributed programs-verification of distributed programs -case study: A Transmission Problem-introduction to fairness.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- do model checking using LTL
- make model checking using CTL
- perform and compare model checking using TCTL and PCTL
- verify deterministic and recursive programs
- verify object-oriented programs, parallel, distributed, and non-deterministic programs

REFERENCES

1. J. B. Almeida, M. J. Frade, J. S. Pinto and S. M. deSousa, "Rigorous Software Development: An Introduction to Program Verification", Springer, 2011
2. C.Baier, J.-P.Katoenand K.G.Larsen, "Principles of Model Checking", MITPress, 2008.
3. E.M.Clarke, O.Grumberg and D.A.Peled, "Model Checking", MIT Press, 1999.
4. M.Ben-Ari, "Principles of the SPIN Model Checker", Springer, 2008.
5. K.R.Apt, F.S.deBoer, E.-R.Olderogand A.Pnueli, "Verification of Sequential andConcurrent Programs", third Edition, Springer, 2010.
6. M.Huth and M.Ryan,"Logic in Computer Science-Modeling and Reasoning about Systems", Second Edition,Cambridge University Press, 2004.
7. B.Berardetal, "Systems and Software Verification: Model-checking techniques and tools", Springer, 2010.

WEBLINKS

1. https://www.mimuw.edu.pl/~vbarany/TL_course.html
2. http://why.lri.fr/manual/manual003.html
3. http://www.inf.ed.ac.uk/teaching/courses/propm/papers/CTL.html

Mapping of Course Outcomes with Programming Outcomes
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16452 **ROBOTICS** **3 0 0 3**

COURSE OBJECTIVES

- To expose the students about the fundamentals of robotic systems
- To understand the concepts of actuators and controls of Robot
- To know about 2D & 3D transformations and its uses
- To expose the knowledge of Cell Design of Robot and its usage in various application
- To learn working principles of Micro /Nano Robotics through various techniques

UNIT I INTRODUCTION **9**

Robot anatomy - Definition, law of robotics, History and Terminology of Robotics - Accuracy and repeatability of Robotics - Simple problems Specifications of Robot-Speed of Robot - Robot joints and links-Robot classifications Architecture of robotic systems - Robot Drive systems Hydraulic, Pneumatic and Electric system.

UNIT II END EFFECTORS AND ROBOT CONTROLS **9**

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type- Magnetic grippers- Vacuum grippers - Air operated grippers-Gripper force analysis - Gripper design-Simple problems - Robot controls- point to point control, Continuous path control, Intelligent robot-Control system for robot joint- Control actions – Feedback Devices - Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III ROBOT TRANSFORMATIONS AND SENSORS **9**

Robot kinematics – Types - 2D, 3D Transformation - Scaling, Rotation, Translation - Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV ROBOT CELL DESIGN AND APPLICATIONS **9**

Robot work cell design and control - Sequence control, Operator interface, Safety monitoring devices in Robot - Mobile robot working principle, actuation using MATLAB, NXT Software Introductions - Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea Robot.

UNIT V MICRO/NANO ROBOTICS SYSTEM **9**

Micro/Nano robotics system overview - Scaling effect - Top down and bottom up approach - Actuators of Micro/ Nano robotics system – Nano robot communication techniques-Fabrication of micro/Nano grippers-Wall climbing micro robot working principles - Biomimetic robot-Swarm robot – Nano robot in targeted drug delivery system.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the basics of robot
- understand end effectors and robot controls
- gain knowledge about robot transformations and sensors
- design robot cell applications
- understand micro/nano robotic systems

REFERENCES

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
3. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach,Phi Learning., 2009.
4. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
5. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
6. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008
7. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill book Co,1987
8. Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.
9. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985.

WEBLINKS

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2. https://www.youtube.com/watch?v=T0SK5A1rwdk
3. https://www.youtube.com/watch?v=o3IhGZY0TCE

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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16453 **BIO - INSPIRED COMPUTING** **3 0 0 3**

COURSE OBJECTIVES

- To understand Cellular Automata and artificial life
- To study artificial neural networks and its evolution
- To learn developmental and artificial& biological immune systems
- To realize behavioral systems especially in the context of Robotics
- To recognize collective systems such as ACO,PSO and swarm robotics

UNIT I EVOLUTIONARYAND CELLULARSYSTEMS 9

Foundations of evolutionary theory – Genotype – artificial evolution – genetic with representations – initial population – fitness functions – selection and reproduction– genetic operators – evolutionary measures –evolutionary algorithms –evolutionary electronics – evolutionary algorithm case study: Cellular systems – cellular automata – modelling with cellular systems – other cellular systems – computation cellular systems –artificial life –analysis and synthesis of cellular systems.

UNIT II NEURALSYSTEMS 9

Biological nervous systems–artificial neural networks –neuron models –architecture –signal encoding– synaptic plasticity– unsupervised learning– supervised learning– reinforcement learning–evolution of neural networks– hybrid neural systems–case study

UNIT III DEVELOPMENTAL AND IMMUNESYSTEMS 9

Rewritingsystems–synthesisofdevelopmentalsystems–evolutionaryrewritingsystems– evolutionary applications developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and –shape space –negative selection algorithm –clonal selection algorithm - examples.

UNIT IV BEHAVIORALSYSTEMS 9

Behaviour is cognitive science – behaviour in AI – behaviour based robotics – biological inspiration for robots–robots as biological models– robot learning–evolution of behavioural systems– learning in behavioural systems– co-evolution of body and control– towards self-reproduction–simulation and reality

UNIT V COLLECTIVE SYSTEMS 9

Biological self-organization –Particle Swarm Optimization (PSO)–ant colony optimization (ACO) – swarm robotics – co-evolutionary dynamics – artificial evolution of competing systems–artificial Evolution of cooperation–case study.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- implement and apply evolutionary algorithm
- explain cellular automata and artificial life
- implement and apply neural system
- explain developmental, artificial immune systems and explain behavioural systems
- implement and apply collective intelligence systems

REFERENCES

1. D.Floreanoand C.Mattiussi,"Bio-InspiredArtificialIntelligence", MITPress, 2008.
2. F. Neumann and C .Witt, " Bio inspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.
3. A.E.ElbenandJ.E.Smith,"IntroductiontoEvolutionaryComputing",Springer,2010.
4. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.

WEB LINKS

1. https://www.youtube.com/watch?v=vxibD6VaOfI
2. https://www.neurobs.com/
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16454 PATTERN RECOGNITION AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To know about supervised and unsupervised learning
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To understand hidden markov models.
- To understand fuzzy pattern classifiers and perception.

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 9

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm - Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of Formal grammars - Syntactic description - Stochastic grammars - Structural representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 9

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V RECENT ADVANCES 9

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the data and identify the patterns.
- analyze the pattern clustering and its validity.
- extract feature set and select the features from given data set.
- identify the hidden markov models.
- understand the advances in fuzzy pattern classifiers.

REFERENCES

1. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.
2. S.Theodoridis and K.Koutroumbas, “Pattern Recognition”, 4th Ed., Academic Press, 2009
3. Robert J.Schalkoff, “Pattern Recognition Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc., New York, 1992.
4. C.M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

5. R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification”, John Wiley, 2001
6. Andrew Webb, “Stastical Pattern Recognition”, Arnold publishers, London,1999.

WEB LINKS

1. http://nptel.ac.in/courses/117108048/
2. http://videolectures.net/Top/Computer_Science/Machine_Learning/Pattern_Recognition/
3. http://www.learnerstv.com/Free-engineering-Video-lectures-ltv832-Page1.htm

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CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16455 **MULTIMEDIA SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

- To learn various operations in multimedia and its uses.
- To recognize the various components of multimedia and the standards
- To realize various multimedia systems used in real time world.
- To study about the multimedia tools and its usage
- To understand how to develop multimedia application

UNIT I INTRODUCTION **9**

Introduction – Multimedia presentation and production – Characteristics – Multiple media – Utilities – Uses – Promotion – Creation – Digital representation – Multimedia architecture.

UNIT II COMPONENTS OF MULTIMEDIA **9**

Text: Text compression - file formats – Image – Audio – Video: Transmission of video signals- Television Broadcasting standards - Digital video standards – Animation: Key frames and Tweening – Principles of animation– 3D animation – file formats– Multimedia documents.

UNIT III MULTIMEDIA SYSTEMS **9**

Visual display systems: Video adapter card – Video adapter cable – Optical storage media – CD technology– DVD technology – Compression: CODEC – Types and techniques – GIF image coding standards –Lossy /Perceptual – JPEG – MPEG-1– MPEG-2 – Fractals.

UNIT IV MULTIMEDIA TOOLS **9**

Authoring Tools: features and types – Card and page based tools – Icon and object based tools – Time based tools – Cross platform authoring notes – Basic software tools: OCR software – 3D modeling and animation tools.

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT **9**

Software life cycle – ADDIE model – Conceptualization – Content collection and processing – Story – Flow line – Script – Storyboard – Implementation – Authoring metaphors – Testing and feedback – Final delivery – Report writing/ documentation – Case study: Web application – Console application – Distributed application – Mobile application – Games consoles – itv – Kiosks

TOTAL PERIODS 45

COURSE OUTCOMES

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

- study of basic multimedia concepts and architecture.
- understand of various multimedia components technology and animation
- understand of multimedia system concepts
- uses of multimedia tools
- applications of multimedia in web and mobile environment.

REFERENCES

1. R. Parekh, Principles of Multimedia, New Delhi: Tata McGraw-Hill, 2010.
2. Tay Vaughan, Multimedia: Making It Work, New Delhi: McGraw-Hill Professional, 2007.
3. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, New Delhi: Pearson Education, 2012.
4. Fred Halsall, Multimedia Communication-Application Networks, Protocols and Standard, Singapore: Addison -Wesley, 2008.

WEB LINKS

1. http://www.tutorialspoint.com/listtutorials/multimedia/1
2. https://www.w3schools.com/html/html_media.asp
3. http://docs.worldviz.com/vizard/Tutorial_Multimedia_(Video,_Audio).html

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2