REGULATIONS 2019

CURRICULUM

(CHOICE BASED CREDIT SYSTEM)

(For the candidates admitted during the academic Year 2019-2020)

SEMESTER I

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	FC	PMA19101	Applied Probability and Statistics	3	0	0	3
2	PC	PCE19101	Advanced Data Structures	3	0	0	3
3	PE I	PCE1915*	Professional Elective I	3	0	0	3
4	PE II	PCE1925*	Professional Elective II	3	0	0	3
5	PC	PEN19101	Research Methodology and IPR	2	0	0	2
6	AC	PEN19171	English for Research Paper Writing (Audit Course I)	2	0	0	0
Practical							
7	PC	PCE19102	Advanced Data Structures Laboratory	0	0	4	2
			TOTAL	**16**	**0**	**4**	**16**

SEMESTER II

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PCE19201	Advanced Algorithms	3	0	0	3
2	PC	PCE19202	Web Analytics and Development	3	0	0	3
3	PE III	PCE1935*	Professional Elective III	3	0	0	3
4	PE IV	PCE1945*	Professional Elective IV	3	0	0	3
5	AC	PEN19271	Pedagogy Studies (Audit Course II)	2	0	0	0
Practical							
6	PC	PCE19203	Advanced Algorithms Laboratory	0	0	4	2
7	PC	PCE19204	Web Analytics and Development Laboratory	0	0	4	2
8	PROJ	PCE19205	Mini Project	0	0	4	2
			TOTAL	**14**	**0**	**12**	**18**

SEMESTER III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	PCE1955*	Professional Elective V	3	0	0	3
2	OE	PCE1990*	Open Elective	3	0	0	3
Practical							
3	PROJ	PCE19301	Dissertation I	0	0	20	10
			TOTAL	**6**	**0**	**20**	**16**

SEMESTER IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Practical							
1	PROJ	PCE19401	Dissertation II	0	0	32	16
			TOTAL	**0**	**0**	**32**	**16**

PROFESSIONAL ELECTIVE I

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PCE19151	Data Preparation and Analysis	3	0	0	3
2.	PE	PCE19152	Secure Coding	3	0	0	3
3.	PE	PCE19153	Introduction to Intelligent Systems	3	0	0	3
4.	PE	PCE19154	Pattern Recognition	3	0	0	3

PROFESSIONAL ELECTIVE II

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PCE19251	Storage Area Network	3	0	0	3
2.	PE	PCE19252	Data Storage Technologies and Network	3	0	0	3
3.	PE	PCE19253	Ethical Hacking	3	0	0	3
4.	PE	PCE19254	Data Virtualization Techniques	3	0	0	3

PROFESSIONAL ELECTIVE III

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PCE19351	Knowledge Discovery	3	0	0	3
2.	PE	PCE19352	Secure Software Design and Enterprise Computing	3	0	0	3
3.	PE	PCE19353	Computer Vision	3	0	0	3
4.	PE	PCE19354	Software Design	3	0	0	3

PROFESSIONAL ELECTIVE IV

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PCE19451	Human and Computer Interaction	3	0	0	3
2.	PE	PCE19452	GPU Computing	3	0	0	3
3.	PE	PCE19453	Digital Forensics	3	0	0	3
4.	PE	PCE19454	Advanced wireless and mobile networks	3	0	0	3

PROFESSIONAL ELECTIVE V

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PCE19551	Mobile Application and Services	3	0	0	3
2.	PE	PCE19552	High Performance Computing	3	0	0	3
3.	PE	PCE19553	Cryptocurrency and Blockchain Technologies	3	0	0	3
4.	PE	PCE19554	Agile Software Development	3	0	0	3

AUDIT COURSE I

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	AC	PEN19171	English for Research Paper Writing	3	0	0	3
2.	AC	PEN19172	Disaster Management	3	0	0	3
3.	AC	PEN19173	Sanskrit for Technical Knowledge	3	0	0	3
4.	AC	PEN19174	Value Education	3	0	0	3

AUDIT COURSE II

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	AC	PEN19271	Pedagogy Studies	3	0	0	3
2.	AC	PEN19272	Constitution of India	3	0	0	3
3.	AC	PEN19273	Stress Management by Yoga	3	0	0	3
4.	AC	PEN19274	Personality Development Through Life Enlightenment Skills	3	0	0	3

OPEN ELECTIVE

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	OE	PMA19901	Operations Research	3	0	0	3
2.	OE	PCE19901	Business Analytics	3	0	0	3
3.	OE	PED19901	Industrial Safety	3	0	0	3
4.	OE	PSE19901	Cost Management of Engineering Projects	3	0	0	3
5.	OE	PED19902	Composite Materials	3	0	0	3
6.	OE	PED19903	Waste to Energy	3	0	0	3

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**
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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

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**
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

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)													
	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	-

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	-