PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637018
(AUTONOMOUS)
REGULATIONS 2023
CHOICE BASED CREDIT SYSTEM
M.E. – COMPUTER SCIENCE AND ENGINEERING
(Applicable to the candidates admitted during the academic year 2023-2024 onwards)

SEMESTER-III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PCE23301	Security Practices	3	0	0	3
2	PE	PCE231**	Professional Elective IV	3	0	0	3
3	PE	PCE231**	Professional Elective V	3	0	0	3
4	OE	*******	Open Elective I	3	0	0	3
Practical							
1	PC	PCE23302	Project Work (Phase I)	0	0	12	6
			TOTAL	**12**	**0**	**12**	**18**

SEMESTER-IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Practical							
1	PC	PCE23401	Project Work (Phase II)	0	0	24	12
			TOTAL	0	**0**	**24**	**12**

PROFESSIONAL ELECTIVE

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	PCE23163	Data Visualization Techniques	3	0	0	3
2	PE	PCE23164	Speech and Natural Language Processing	3	0	0	3
3	PE	PCE23165	Cloud Computing Technologies	3	0	0	3
4	PE	PCE23166	High Performance Computing for Big Data	3	0	0	3
5	PE	PCE23167	Web Analytics	3	0	0	3
6	PE	PCE23168	Social Network Analysis	3	0	0	3
7	PE	PCE23169	Randomized Algorithms	3	0	0	3
8	PE	PCE23170	Compiler Optimization Techniques	3	0	0	3

OPEN ELECTIVE

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	OE	PED23901	Industrial Safety	3	0	0	3
2	OE	PSE23901	Climate change and Adaptation	3	0	0	3
3	OE	PPS23901	Alternate Energy Sources	3	0	0	3
4	OE	PCS23901	Design of Digital Elements	3	0	0	3
5	OE	PCE23901	Big Data Analytics	3	0	0	3

PCE23301	SECURITY PRACTICES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

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

UNIT I	SYSTEM SECURITY	9

Information Security in the Modern Enterprise; Building a secure organization ; A Cryptography primer; Verifying User and Host Identity; Intrusion detection system; Intrusion Prevention system ;Security web applications; Case study: OWASP ,Top 10 Web Application Security Risks.

UNIT iI	NETWORK SECURITY	9

Internet Security ;Botnet Problem; Intranet security; Local Area Network Security ; Wireless Network Security ;Wireless Sensor Network Security; Cellular Network Security ; IOT security ; Case Study - Kali Linux.

UNIT III	SECURITY MANAGEMENT	9

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

UNIT IV	CYBER SECURITY, CRYPTOGRAPHY AND CLOUD SECURITY	9

Cyber Forensics and Incidence Response; Securing e-Discovery; Hard Drive Imaging; Metadata Forensics ;Data Encryption; Satellite Encryption; Password based authenticated Key establishment Protocols, Best security practices for automate Cloud infrastructure management – Establishing trust in IaaS, PaaS, and SaaS Cloud types.

UNIT V	PRIVACY AND STORAGE SECURITY	9

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

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	understand the core fundamentals of system security	Understanding (K2)
CO2	understand the security concepts to wired and wireless networks	Understanding (K2)
CO3	implement and manage the security essentials in it sector	Applying (K3)
CO4	explain the concepts of cyber security, cryptography and cyber forensics	Understanding (K2)
CO5	be aware of privacy and storage security issues	Applying (K3)

REFERENCES

1. John R. Vacca, Computer and Information Security Handbook, Third Edition, Elsevier 2017.
2. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Seventh Edition, Cengage Learning, 2022.
3. Richard E. Smith, Elementary Information Security, Third Edition, Jones and Bartlett Learning, 2019.
4. Mayor, K.K.Mookhey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007.
5. Siani Pearson, George Yee "Privacy and Security for Cloud Computing" Computer Communication and Networks, Springer, 2013.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	1	3	1	1	1	1	1
CO2	1	1	2	2	1	1	1	1
CO3	3	2	2	3	1	1	1	1
CO4	2	2	3	1	1	1	1	1
CO5	1	1	2	1	2	1	1	1

PCE23302	PROJECT WORK (PHASE I)	0	0	12	6

COURSE OBJECTIVES	
To enable the students to	
1	apply the fundamental knowledge for understanding state of the art information about any topic relevant to curriculum
2	identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literatures
3	develop the methodology to solve the identified problems.
4	enhance the presentation and documentation skills in order to disseminate solution to the real world challenging problems.

The project topic should be selected to ensure the satisfaction need to establish a direct link between education, national development and productivity and reduce the gap between the world of work and the world of study.

The student should complete the following for Phase I

- Literature survey and formulate the problem.
- Develop preliminary design approaches.
- Implement and verify the project.
- Prepare a detailed report and presentation.
- Present findings in reputable journals and international conferences

	TOTAL PERIODS	180
COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas.	Applying (K3)
CO2	create a suitable method from different methodologies and forms of analysis to produce research design.	Applying (K3)
CO3	demonstrate the developed /implemented system in the form of hardware and/or software and complement to the society.	Applying (K3)
CO4	present the technical findings in written report/ product and be able to present the ideas in reputed journals and/or International Conferences.	Applying (K3)

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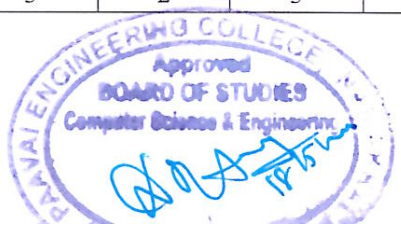
COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	2	3	3	2	2
CO2	3	3	3	2	3	3	2	1
CO3	3	3	3	2	3	3	2	3
CO4	3	3	3	2	3	3	2	3



PCE23401	PROJECT WORK (PHASE II)	0	0	24	12

COURSE OBJECTIVES

To enable the students to

1	apply the fundamental knowledge for understanding state of the art information about any topic relevant to curriculum
2	identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literatures
3	develop the methodology to solve the identified problems.
4	enhance the presentation and documentation skills in order to disseminate solution to the real world challenging problems.

The project topic should be selected to ensure the satisfaction need to establish a direct link between education, national development and productivity and reduce the gap between the world of work and the world of study.

The student should complete the following for Phase II

- Literature survey and formulate the problem.
- Develop preliminary design approaches.
- Implement and verify the project.
- Prepare a detailed report and presentation.
- Present findings in reputable journals and international conferences

TOTAL PERIODS	**360**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas.	Applying (K3)
CO2	create a suitable method from different methodologies and forms of analysis to produce research design.	Applying (K3)
CO3	demonstrate the developed /implemented system in the form of hardware and/or software and complement to the society.	Applying (K3)
CO4	present the technical findings in written report/ product and be able to present the ideas in reputed journals and/or International Conferences.	Applying (K3)

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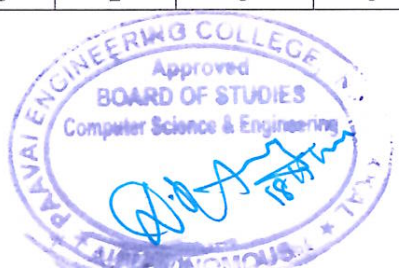
COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	2	3	3	2	2
CO2	3	3	3	2	3	3	2	1
CO3	3	3	3	2	3	3	2	3
CO4	3	3	3	2	3	3	2	3



PCE23163	DATA VISUALIZATION TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	develop skills to both design and critique visualizations.
2	introduce visual perception and core skills for visual analysis.
3	understand technological advancements of data visualization
4	understand various data visualization techniques
5	understand the methodologies used to visualize large data sets

UNIT I	INTRODUCTION OF VISUALIZATION	9

History of Data Visualization; Data Visualization Through Their Graph Representations; Graph-theoretic Graphics; High-dimensional Data Visualization; Multivariate Data Glyphs; Principles and Practice; Linked Views for Visual Exploration; Linked Data Views- Visualizing Trees and Forests.

UNIT II	METHODOLOGIES	9

Multidimensional Scaling; Multivariate Visualization by Density Estimation; Structured Sets of Graphs; Structural Adaptive Smoothing by Propagation; Separation Methods; Smoothing Techniques for Visualisation, Data Visualization via Kernel Machines; Visualizing Cluster Analysis and Finite Mixture Mode; Visualizing Contingency Tables ; Parallel Coordinates ; Visualization - Exploration and Classification of High ;Dimensional Data ;Matrix Visualization.

UNIT III	DATA TO VISUALIZATION	9

Visualizing Data: Mapping Data onto Aesthetics; Coordinate Systems and Axes; Color Scales; Directory of Visualizations; Visualizing Amounts; Visualizing Distributions-Histograms and Density Plots; Visualizing Many Distributions at Once; Visualizing Proportions- Visualizing Nested Proportions; Visualizing Associations Among Two or More Quantitative Variables.

UNIT IV	PRINCIPLES OF FIGURE DESIGN	9

The Principle of Proportional Ink; Handling Overlapping Points; Common Pitfalls of Color Use; Redundant Coding ;Multipanel Figures ;Titles, Captions, and Tables-Balance the Data and the Context

UNIT V	APPLICATION IN VISUALIZATION	9

Visualization for Genetic Network Reconstruction, Reconstruction ; Visualization and Analysis of Medical Images; Exploratory Graphics of a Financial Dataset ; Graphical Data Representation in Bankruptcy Analysis ; Visualizing Functional Data with an Application- Visualization Tools for Insurance Risk Processes.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	represent the objects in different dimensions.	Understanding (k2)
CO2	analyze and process the data for Visualization.	Analyzing (k4)
CO3	apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences.	Applying (k3)
CO4	apply the virtualization techniques for research projects	Applying (k3)
CO5	identify appropriate data visualization techniques given particular requirements imposed by the data.	Understanding (k2)

REFERENCES

1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008
3. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021
4. Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", 1st Edition, O'Reilly, 2006.
5. Claus O.wilke,Orilly "Fundamentals of Data Visualization",1st Edition, 2019.

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COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	1	1	2	2	1	2	1
CO2	1	1	1	2	2	1	2	1
CO3	2	1	2	2	1	1	1	2
CO4	1	1	1	3	1	1	1	1
CO5	1	1	2	2	2	1	2	1

PCE23164	SPEECH AND NATURAL LANGUAGE PROCESSING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the fundamentals of knowledge in speech and language processing.
2	learn about automatic speech recognition systems and their underlying mechanism.
3	understand statistical parsing methods and their application in natural language understanding.
4	know about lexical semantics and its role in computational linguistics.
5	explore information extraction techniques and their applications in text analysis.

UNIT I	INTRODUCTION	9

Introduction to Knowledge in Speech and Language Processing – Regular Expressions and Automata– Words & Transducers; N-grams – Hidden Markov and Maximum Entropy models.

UNIT II	SPEECH	9

Phonetics–Speech Synthesis, Automatic speech Recognition; Speech Recognition: Advanced Topics– Computational Phonology.

UNIT III	SYNTAX	9

Formal Grammars of English– Parsing with Content Free Grammars – Statistical Parsing –Features and Unification – Language and Complexity.

UNIT IV	SEMANTICS AND PRAGMANTICS	9

Representing Meaning – Computational Semantics, Lexical Semantics; Computational Discourse, Coreference Resolution.

UNIT V	APPLICATIONS	9

Information Extraction – Question Answering and Summarization – Dialogue and conversational agents – Machine Translation

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain the concepts and principles of knowledge in speech and language processing.	Understanding (K2)
CO2	determine the practical experience in synthesizing speech and understanding the techniques involved.	Applying (K3)
CO3	identify the features and unification in syntax and their impact on language complexity	Understanding (K2)
CO4	explain the skills in computational semantics and its applications in language understanding tasks.	Understanding (K2)
CO5	illustrate the principles behind question answering and summarization systems and their practical implementation	Applying (K3)

REFERENCES

1. James Allen, Benjamin /Cummings, "Natural Language Understanding", 2nd edition, 1995.
2. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA: 1999.
3. Bharati A., Sangal R., ChaitanyaV.. Natural language processing: a Paninian perspective, PHI, 2000.
4. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP 2008.
5. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.
6. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", Massachusetts Institute of Technology, 2003.

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CO's	PO's						PSO's	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	2	1	1	2	1	1	2
CO2	2	1	1	1	1	1	2	2
CO3	1	1	3	2	2	1	1	2
CO4	2	3	2	1	2	1	1	2
CO5	1	1	1	2	2	1	2	1

PCE23165	CLOUD COMPUTING TECHNOLOGIES	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	articulate the differences between deployment model and service model of cloud computing
2	impart virtualization technologies, resource management techniques and scheduling schemes in Cloud environments.
3	understand the architecture, infrastructure and delivery models of cloud computing
4	understand the various issues in cloud computing
5	enhance knowledge on different types of programming models to deploy web applications with security in the cloud

UNIT I	CLOUD COMPUTING BASICS	9

Defining Cloud computing - Cloud Types, Characteristics of Cloud computing; Cloud Architecture - Cloud Computing Stack; Infrastructure as a service- Platform as a Service, Software as a Service, Identity as a Service, Compliance as a Service.

UNIT II	PLATFORMS AND VIRTUALIZATION	9

Abstraction and Virtualization – Load Balancing and Virtualization; Hypervisors; Machine Imaging; Porting Applications; Capacity Planning- Defining Baseline and Metrics, Network Capacity.

UNIT III	CLOUD BASED SERVICES AND TOOLS	9

Defining Services; PaaS Application Frameworks; Google Web Services- Exploring Google Applications; Google Toolkit; Amazon Web Services - Amazon Web Service Components and Services; Amazon Storage Systems; Microsoft Cloud Services - Microsoft Cloud Services; Windows Azure Platform, SQL Azure, Windows Live.

UNIT IV	MANAGING AND SECURING THE CLOUD	9

Administrating the cloud-Cloud Management Products, Cloud Management Standards; Securing the cloud; Securing Data; Establishing Identity and Presence.

UNIT V	CLOUD BASED STORAGE	9

Digital Universe; Provisioning Cloud Storage; Cloud Backup Solutions; Cloud Storage Interoperability. Mobile Cloud: Mobile Market; Smartphones with the cloud; Mobile web services-Service types; Service Discover.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	employ the concepts of cloud management	Understanding (K2)
CO2	apply the concept of virtualization in the cloud computing	Applying (K3)
CO3	apply the emerging technologies in the cloud environment	Applying (K3)
CO4	avail the services using cloud computing	Applying (K3)
CO5	identify the basic knowledge of network storage	Understanding (K2)

REFERENCES

1. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley Publishing, 2015.,
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rajkumar Buyya, James Broberg & Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2013
4. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner"s Guide", McGraw-Hill Osborne Media, 2009.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw- Hill Osborne Media, 2009

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COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	1	3	3	2	2	1	2
CO2	1	1	3	3	2	2	1	2
CO3	2	2	3	3	2	2	1	2
CO4	1	2	3	3	2	2	1	2
CO5	1	1	2	2	1	2	1	2

PCE23166	HIGH PERFORMANCE COMPUTING FOR BIG DATA	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	familiarize students with high-performance technologies used in big and fast data analytics.
2	explore the network, storage infrastructures for high-performance big data analytics
3	study various high-performance, database processing, memory analytics in big data analytics.
4	explore visualization techniques crucial for high-performance big data analytics.
5	examine the use of big data analytics in healthcare applications.

UNIT I	INTRODUCTION OF IT LANDSCAPE & BIG DATA	9
Trends and Transformations in the IT Landscape; The High-Performance Technologies for Big and Fast Data Analytics; Big and Fast Data Analytics Yearning for High Performance Computing.		

UNIT II	NETWORK INFRASTRUCTURE FOR HIGH PERFORMANCE BDA	9
Network Infrastructure for High-Performance Big Data Analytics; Storage Infrastructures for High-Performance Big Data Analytics; Real-Time Analytics Using High-Performance Computing.		

UNIT III	HIGH PERFORMANCE COMPUTING USING DATABASES	9
High-Performance Computing (HPC) Paradigms; In-Database Processing and In-Memory Analytics; High-Performance Integrated Systems, Databases and Warehouses for Big and Fast Data Analytics.		

UNIT IV	HPC USING GRIDS AND CLUSTERS	9
High-Performance Grids and Clusters; High-Performance Peer-to-Peer Systems; Visualization Dimensions for High- Performance Big Data Analytics.		

UNIT V	BIG DATA APPLICATIONS	9
Social Media Analytics for Organization Empowerment; Big Data Analytics for Healthcare.		

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	understand various technologies employed in big and fast data analytics.	Understanding (K2)
CO2	analyze different storage solutions tailored for efficient data processing in big data environments.	Analyzing (K4)
CO3	apply integrated systems and data warehouses designed for handling big and fast data analytics tasks.	Applying (K3)
CO4	apply visualization techniques to effectively interpret and communicate insights from big data analytics.	Applying (K3)
CO5	understand the applications of big data analytics in improving healthcare outcomes and services.	Understanding (K2)

REFERENCES

1. Pethuru Raj, Anupama Raman, Dhivya Nagaraj and Siddhartha Duggirala, "High- Performance Big-Data Analytics: Computing Systems and Approaches", Springer, 1st Edition, 2015.
2. "Big Data Management and Processing", Kuan-Ching Li, Hai Jiang, Albert Y. Zomaya,CRC Press, 1st Edition, 2017.
3. "HighPerformanceComputingforBigData:MethodologiesandApplications",Chao wang, CRC Press,1st Edition,2018

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COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	2	3	3	1	2	1	2
CO2	2	2	3	3	1	2	1	2
CO3	2	2	3	3	1	2	1	2
CO4	2	3	3	3	1	2	2	2
CO5	2	2	3	3	2	2	1	2

PCE23167	WEB ANALYTICS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	understand the fundamentals and classifications of web analytics.
2	mastering clickstream analysis for actionable insights
3	enhancing proficiency in web testing and analysis
4	applying optimal solutions to identify and overcome hidden web analytics traps
5	building a successful career in web analytics

UNIT I	INTRODUCTION	9

The Bold New World Of Web Analytics 2.0;State of the Analytics Union, State of the Industry-Rethinking Web Analytics; Meet Web Analytics 2.0, Clickstream, Multiple Outcomes Analysis, Experimentation and Testing; The Optimal Strategy for Choosing Your Web Analytics Soul Mate; The Awesome World of Clickstream Analysis: Metrics-Eight Critical Web Metrics, Bounce Rate, Exit Rate, Conversion Rate; Starting with Macro Insights

UNIT II	THE POWER OF CLICKSTREAM ANALYSIS	9

The Awesome World of Clickstream Analysis-A Web Analytics Primer-Fixing Stuff and Saving Money-Foundational Analytical Strategies, -Everyday Clickstream Analyses Made Actionable, Internal Site Search Analysis, Search Engine Optimization (SEO) Analysis, Direct Traffic Analysis-Measuring Macro and Micro Conversions/Examples –Surveys-Types of Surveys, Three Greatest Survey Questions Ever, Web-Enabled Emerging User Research Options

UNIT III	TESTING AND ANALYSIS	9

Unleashing the Power of Testing and Experimentation-A Primer on Testing Options: A/B and MVT; Creating and Nurturing a Testing Culture; Competitive Intelligence Analysis- CI Data Sources, Types, and Secrets; Website Traffic Analysis, Search and Keyword Analysis; Emerging Analytics: Social, Mobile, and Video-Measuring the Success of Blogs; Analyzing Performance of Videos

UNIT IV	OPTIMAL SOLUTIONS FOR HIDDEN WEB ANALYTICS TRAPS	9

A Six-Step Process for Dealing with Data Quality; Five Rules for High-Impact Dashboards; Online Data Mining and Predictive Analytics-Type of Data, Number of Variables, Multiple Primary Purposes, Missing Primary Keys and Data Sets; Comparing KPI Trends Over Time; Four In actionable KPI Measurement Techniques; Multichannel Analytics

UNIT V	THE WEB ANALYTICS CAREER	9

Planning a Web Analytics Career; Cultivating Skills for a Successful Career in Web Analysis; Changing Metric Definitions to Change Cultures; Five Rules for Creating a Data-Driven; Strategies to Break Down Barriers to Web Measurement.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	understand the evolution to web analytics 2.0 and its significance	Understanding (K2)
CO2	understand the foundational principles of clickstream analysis in web analytics	Understanding (K2)
CO3	implement A/B and multivariate testing (MVT) techniques effectively to optimize outcomes.	Applying (K3)
CO4	apply online data mining and predictive analytics techniques, considering types of data, variables, primary purposes, and handling missing primary keys.	Understanding (K2)
CO5	develop strategies to overcome barriers and challenges in web measurement.	Applying (K3)

REFERENCES

1. Avinash Kaushik, Web Analytics 2.0, The Arts Of Online Accountability And Science Of Customer Centricity- Copyright © 2010 by Wiley Publishing,
2. Michael Beasley,-Practical Web Analytics For User Experience: How Analytics Can Help You Understand Your User||,Morgan-Kaufmann,2013
3. Justin Cutroni,-Google Analytics||,O'Reilly,2010

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COs	Programme Outcomes(POs)							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**
CO1	2	2	3	2	1	2	1	2
CO2	2	2	3	2	1	2	1	2
CO3	2	2	3	2	1	2	1	2
CO4	2	3	3	2	1	2	1	2
CO5	2	2	3	2	2	2	1	2

PCE23168	SOCIAL NETWORK ANALYSIS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	transform data for analysis using graph-based and statistics-based social network measures
2	choose among social network behavior based on research goals
3	understand the basic concepts and principles of different algorithms of social networks analysis.
4	analyze social media data to comprehend user sentiments and recommend the essential information appropriately.
5	understand the fundamental concepts in analyzing the large-scale data models that are derived from social networks

UNIT I	SOCIAL NETWORK AND GRAPH	9
Introduction-Important tools and analysis of online network data; Python libraries and associated packages, Execution of SNA in real time application, SNA and Graph representation; Real-time product from SNA-Indices employed in Social Network-Tools to analyze Network-Scope of python in SNA- Use Case-Real-Time product from SNA- Aspects of the network-Graph-Scale free networks-Network Data Sets.		
UNIT II	**CASCADING BEHAVIOR AND PRAGMATIC ANALYSIS**	**9**
Introduction; User behavior; Cascaded behavior; Social Media Analytics; Conventional strategies in Data Mining techniques; Research Gaps in the current scenario; Introduction to Pragmatic analysis; Background; Proposed model; Building Social Ontology under the agriculture Domain-Validation.		
UNIT III	**CLASSIFICATION OF ANOMALOUS ACTIVITIES AND ALGORITHMS**	**9**
Introduction; Methodology; Implementation; Basis of Machine learning approach; Forecast the word in social media related works; TF-IDF Technique, Time series.		
UNIT IV	**SENTIMENT ANALYSIS AND MODELS**	**9**
Sentiment Analysis; Techniques in sentiment Analysis; Implementation of sentiment Analysis and Results; Future Scope; Introduction to Cascades; Cascade Networks-Importance of Cascades; Cascade Capacity; Models of Network Cascades, Centrality, Cascading failures; Behavior example using python.		
UNIT V	**EXPLORING SOCIAL NETWORKING DATA SETS**	**9**
Introduction; Establishing a Social Network; Connectivity of users in social Networks; Centrality measures in social networks; Case study of Facebook.		
	TOTAL PERIODS	**45**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	prepare and execute network analytical computations.	Understanding (K2)
CO2	use social network analysis in behavior analytics	Analying (K4)
CO3	implement mining algorithms for social networks	Applying (K3)
CO4	analyze and evaluate social communities	Applying (K3)

CO5	performing on large social networks and illustrate the results	Analying (K4)

REFERENCES

1. Social Network Analysis:Theory and Applications, Mohammad GouseGalety, Sachi Nandan Mohanty,Chiai Al Atroshi, Buni Balabantaray, John Wiley & Sons,2022.
2. John Scott, Peter J. Carrington, "The SAGE Handbook of Social Network Analysis", Sage Publication
3. Social network analysis: methods and applications, Stanley Wasserman, and KatherineF'Aust. Cambridge university press.
4. Social Network Analysis: History, Theory and Methodology by Christina Prell, SAGE Publications; 1st edition.
5. Sentiment Analysis in Social Networks, Federico Alberto Pozzi, Elisabetta Fersini, Enza Messina, and Bing.LiuElsevierInc, 1stedition.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	2	3	3	1	2	1	2
CO2	3	2	3	3	1	2	2	2
CO3	3	2	3	3	1	2	2	2
CO4	3	2	3	3	1	2	2	2
CO5	3	2	3	3	1	2	2	2

PCE23169	RANDOMIZED ALGORITHMS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	understand the mathematical foundations needed for understanding and designingrandomized algorithms.
2	expose the inequalities and probabilistic methods.
3	understand the concept of random walk and Algebraic techniques.
4	expose the Data Structures and Graph algorithms.
5	implement the Approximate counting and Parallel and distributed algorithms.

UNIT I	INTRODUCTION, GAME-THEORETIC TECHNIQUES AND MOMENTS AND DEVIATIONS	9

Introduction-Min-Cut Algorithm, Binary Planar Partitions; Game-Theoretic Techniques-Game Tree Evaluation, The Minimax principle, Randomness and Non-uniformity; Moments And Deviations-Occupancy Problems, Markov and Chebyshev Inequalities, Randomized Selection, Two-point Sampling, Stable Marriage Problem and Coupon Collector's Problem.

UNIT II	TAIL INEQUALITIES AND THE PROBABILISTIC METHOD	9

Tail Inequalities-Chernoff Bound, Routing in a parallel Computer, A wiring Problem,Martingales; The Probabilistic Method- Overview, Maximum Satisfiability, Expanding Graphs, Lovasz Local Lemma and Method of Conditional Probabilities.

UNIT III	MARKOV CHAINS AND RANDOM WALKS AND ALGEBRAIC TECHNIQUES	9

Markov Chains and Random Walks-A 2-SAT Example, Markov Chains, Random Walks on Graphs, Electrical Networks, Cover Times, Graph Connectivity, Expanders and Rapidly Mixing Random Walks; Algebraic techniques-Fingerprinting and Freivalds Technique, verifying polynomial identities, perfect matchings in graphs, verifying equality of strings, pattern matching, Interactive proof systems.

UNIT IV	DATA STRUCTURES AND GRAPH ALGORITHMS	9

Data Structures-Fundamental Data-structuring problem, Random Treaps, Skip Lists, HashTables and Hashing; Graph algorithms-All-pairs Shortest Paths, Min-cut Problem, Minimum Spanning Trees.

UNIT V	APPROXIMATE COUNTING AND PARALLEL AND DISTRIBUTED ALGORITHMS	9

Approximate Counting-Randomized Approximation Schemes, DNF Counting Problem, Volume Estimation; Parallel and distributed algorithms-PRAM model and its sorting, Maximal Independent Sets, Perfect Matching, Choice Coordination Problem, Byzantine Agreement.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	identify the need for randomized algorithms	Understanding (K2)
CO2	discuss the different probabilistic methods used for designing randomized algorithms	Analyzing (K4)
CO3	present the various paradigms for designing randomized algorithms	Understanding (K2)
CO4	design with data structures and graph algorithms	Applying (K3)
CO5	apply the techniques studied to design algorithms for different parallel and distributed algorithms	Applying (K3)

REFERENCES

1. Michael Mitzenmacher and EliUpfal ,"Probability and Computing: Randomized Algorithms and Probabilistic Analysis",
2. Grimmett and Stirzaker, "Probability and Random Processes", Oxford, 2001.
3. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", 1st Edition, Cambridge University Press, Reprint 2010.

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CO3	3	2	3	2	1	2	1	2
CO4	3	2	3	2	1	2	1	2
CO5	3	2	3	2	1	2	1	2

PCE23170	COMPILER OPTIMIZATION TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the optimization techniques used in compiler design.
2	be aware of the various machine-independent optimizations.
3	aware of the various computer architectures that support parallelism
4	become familiar with the theoretical background needed for code optimization.
5	understand the techniques used for identifying parallelism in a sequential program.

UNIT I	INTRODUCTION	9

Language Processors; The Structure of a Compiler; The Evolution of Programming Languages; The Science of Building a Compiler; Applications of Compiler Technology; Programming Language Basics; Issue in design of a Code Generator; The target language; Addresses in the Target code; Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks; A simple Code generator; Peephole Optimization; Register Allocation and Assignment; Instruction selection by tree rewriting.

UNIT II	MACHINE-INDEPENDENT OPTIMIZATIONS	9

Principle Sources of Optimization; Data flow analysis ; Foundation of Data flow analysis; Constant Propagation; Partial Redundancy Elimination; Loops in Flow Graphs ; Region – based Analysis; Symbolic Analysis.

UNIT III	INSTRUCTION-LEVEL PARALLELISM	9

Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Advanced code motion techniques- Interaction with Dynamic Schedulers; Software Pipelining.

UNIT IV	OPTIMISING FOR PARALLELISM AND LOCALITY-THEORY	9

Basic Concepts – Matrix-Multiply: An In-Depth Example - Iteration Spaces - Affine Array Indexes – Data Reuse- Array data dependence Analysis.

UNIT V	OPTIMISING FOR PARALLELISM AND LOCALITY – APPLICATION	9

Finding Synchronization; Synchronization Between Parallel Loops; Pipelining; Locality Optimizations; Other Uses of Affine Transforms.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	design and implement techniques used for optimization by a compiler.	Understanding (K2)
CO2	understand the various machine-independent optimizations.	Analyzing (K4)

CO3	modify the existing architecture that supports parallelism.	Understanding (K2)
CO4	modify the existing data structures of an open source optimizing compiler	Applying (K3)
CO5	Design and implement new data structures and algorithms for code optimization	Applying (K3)

REFERENCES

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers:Principles, Techniques and Tools", Second Edition, Pearson Education,2008.
2. Andrew W. Appel, Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2002.
3. Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition, 2011.
4. Randy Allen and Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufman, 2002.

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CO5	3	2	3	2	1	2	1	2

PCE23901	BIG DATA ANALYTICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	gain insights into exploratory data analysis and statistical evaluation methods
2	understand the concepts and architecture of data stream processing
3	learn about input and output formats, features, and library classes used in MapReduce
4	understand Hadoop's distributed file system (HDFS) and its design principles
5	Understand the use of Pig and Hive for Big Data processing and querying

UNIT I **INTRODUCTION TO BIG DATA** **9**

Big Data Overview; State of the Practice in Analytics; Key Roles for the New Big Data Ecosystem; Examples of Big Data Analytics; Data Analytics Lifecycle - Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize; Exploratory Data Analysis; Statistical Methods for Evaluation.

UNIT II **MINING DATA STREAMS** **9**

Introduction To Streams Concepts – Stream Data Model and Architecture; Sampling Data in a Stream: Filtering Streams; Counting Distinct Elements in a Stream; Estimating Moments; Counting Oneness in a Window; Decaying Window; Real time Analytics Platform (RTAP) Applications. Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III **MAPREDUCE** **9**

MapReduce Types; Input formats; Output formats; MapReduce features – Counters; Sorting; joins; Side Data Distribution; Map reduce Library Classes. MapReduce and new software stack – Algorithms using MapReduce; Extension to MapReduce.

UNIT IV **HADOOP** **9**

History of Hadoop- – Components of Hadoop; Analyzing the Data with Hadoop; Scaling Out; Hadoop Streaming; The Hadoop Distributed File System –HDFS Concepts; Hadoop File Systems; Design of HDFS; Java interfaces; Dataflow; Parallel copying with distcp; Hadoop I/O – Data integrity; Compression; Serialization.

UNIT V **FRAMEWORKS** **9**

Applications on Big Data Using Pig and Hive; Data processing operators in Pig; Hive services; HiveQL; Querying Data in Hive; HBase - Concepts; HBase Versus RDBMS; ZooKeeper – ZooKeeper Service; Building applications with Zookeeper; ZooKeeper in production.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	apply data analysis techniques to analyze and interpret data.	Understanding (K2)
CO2	explain the stream data model and architecture for real-time data processing	Understanding (K2)
CO3	identify and utilize various input and output formats in	Applying (K3)

	MapReduce	
CO4	explain the architecture and design of HDFS and its role in data storage	Understanding (K2)
CO5	apply Pig and Hive for data processing	Applying (K3)

REFERENCES

1. EMC Education Services (Editor), "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 1st Edition, John Wiley & Sons, 2015.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd edition 2020.
3. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
5. Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businessesl, Wiley Publications, 2013

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CO4	3	1	1	2	1	2	3	2
CO5	2	1	2	3	1	2	2	3