E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM – 611002

(Affiliated to Anna University, Chennai | Accredited by NAAC with „A++" Grade|Accredited by NBA T1(B.E. – CSE, CIVIL, ECE, EEE, MECH& B.Tech – IT) | Approved by AICTE, New Delhi)

M.E. - COMPUTER SCIENCE AND ENGINEERING R- 2024

SECOND YEAR

CURRICULUM AND SYLLABUS FOR THIRD SEMESTER

SEMESTER III									
Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
						CA	**ES**	**Total**	
Theory Course									
	Program Elective–V	3	0	0	3	40	60	100	PEC
	Open Elective	3	0	0	3	40	60	100	OEC
Laboratory Course									
2404CP301	Project Work–Phase I	0	0	20	10	50	50	100	EEC
Total		**6**	**0**	**20**	**16**	**130**	**170**	**300**	

L-Lecture |T –Tutorial |P- Practical |CA – Continuous Assessment |ES – End Semester

SEMESTER - III,ELECTIVE –V

SL. NO.	COURSECODE	COURSETITLE	CATEGORY	PERIODSPERWEEK			TOTAL CONTACTPERIODS	CREDITS
				L	T	P		
1.	2403CP021	Big Data Analytics	PEC	3	0	0	3	3
2.	2403CP022	Information Retrieval Techniques	PEC	3	0	0	3	3
3.	2403CP023	Foundation of Data Science	PEC	3	0	0	3	3
4.	2403CP024	Data Warehousing and Data Mining	PEC	3	0	0	3	3
5.	2403CP025	Intelligent Optimization Techniques	PEC	3	0	0	3	3

OPENELECTIVECOURSES [OEC]

SL. NO.	COURSECODE	COURSETITLE	CATEGORY	PERIODSPERWEEK			TOTAL CONTACTPERIODS	CREDITS
				L	T	P		
1.	2403CP026	Internet of Things	OEC	3	0	0	3	3
2.	2403CP027	Ethical Hacking and Applied Cryptography	OEC	3	0	0	3	3
3.	2403CP028	Social Network Analysis	OEC	3	0	0	3	3
4.	2403CP029	Cyber Forensics	OEC	3	0	0	3	3
5.	2403CP030	Social Media Web Analysis	OEC	3	0	0	3	3
6.	2403CP031	Knowledge Engineering and Management	OEC	3	0	0	3	3

2403CP021	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basic concepts on Data Mining and Data warehousing

COURSE OBJECTIVES:

1. To understand the fundamental concepts of Big Data.
2. To gain in-depth knowledge about the Hadoop Architecture and YARN.
3. To apply the key concepts of Hadoop framework, MapReduce, Pig, Hive, and Zoo Keeper

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Analyze the Big Data concepts, file system and Applications.
CO2:	Apply the knowledge of HadoopI/O and Data visualization techniques.
CO3:	Analyze the Hadoop and Map Reduce framework associated with big data.
CO4:	Apply the fundamentals of Hadoop YARN and Map Reduce Programming for Big Data Applications.
CO5:	Develop the applications Using Pig, Hive and ZooKeeper.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	2	-	-	-	-	-	-	2	3
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	3	3	-	-	-	-	-	-	2	3
CO4	3	3	3	3	2	2	-	-	-	-	-	-	2	3
CO5	2	3	3	1	3	3	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO BIG DATA**	**9 Hours**

Introduction - Four Vs, Drivers for Big data, Big data analytics, Big data applications. Challenges of conventional systems -Intelligent data analysis -Nature of data - Analytic processes and tools–Analysis Vs Reporting - Modern data analytic tools

MODULE II	**INTRODUCTION TO HADOOP**	**9 Hours**

Big Data -Apache Hadoop&HadoopEcoSystem -Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization -Data Visualization Techniques- Introduction to Spark.

MODULE III	**HADOOP ARCHITECTURE**	**9 Hours**

Hadoop Architecture, HadoopStorage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, HadoopMapReduceparadigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup -SSH &Hadoop- Configuration -HDFS Administering -Monitoring & Maintenance.

MODULE IV	**HADOOP ECOSYSTEM AND YARN**	9 Hours

Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features NameNode High Availability, HDFS Federation, Map Reducev2, YARN, Running Map Reducev1 inYARN.

MODULE V	**HIVE, PIG AND HBASE**	**9 Hours**

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL -Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins &Subqueries, HBase concepts-Advanced Usage, Schema Design, Advance Indexing - Mahout - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

TOTAL: 45 HOURS
REFERENCES:
1. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, Professional Hadoop Solutions, Wiley, ISBN: 9788126551071, 2015.
2.Tom Plunkett, Brian Macdonaldetal, "Oracle BigData Handbook, Oracle Press", 2014.
3. VigneshPrajapati, "BigData Analytics with R and Hadoop",Packet Publishing 2013
4.Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2013.
5. Tom White, "HADOOP: The definitive Guide" , O'Reilly, 2012.
6. https://archive.nptel.ac.in/courses/106/104/106104189/

2403CP022	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

PREREQUISITE:

Probability and Statistics, Programming skills

COURSE OBJECTIVES:

1. To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
2. To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
3. To learn measuring effectiveness and efficiency of information retrieval techniques.
4. To get used to performing Parallel Information Retrieval.
5. To understand the concepts of digital libraries

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Build an Information Retrieval system using the available tools.
CO2:	Identify and design the various components of an Information Retrieval system.
CO3:	Measure effectiveness and efficiency of information retrieval techniques.
CO4:	Use parallel Information Retrieval approaches in real world problems
CO5:	Design an efficient search engine and analyze the Web content structure

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	-	-	-	-	-	-	-	-	2	3
CO2	3	-	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	-	3	-	-	-	-	-	-	-	-	-	2	3
CO4	3	-	3	-	-	-	-	-	-	-	-	-	2	3
CO5	2	-	3	2	-	-	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I **INTRODUCTION** **9 Hours**

Basic Concepts – Practical Issues – Retrieval Process – Architecture – Boolean Retrieval – Retrieval Evaluation –The impact of the web on IR –IR Versus Web Search–Components of a Search engine. Basic Text Processing: Tokenization, Stopwords, Stemming, Lemmatization, Zipf‟s and Heap‟s law-Spelling correction and Edit distances: Hamming distance, Longest common Subsequence, Levenstein edit distance.

MODULE II **RETRIEVAL MODELING** **9 Hours**

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting– Scoring and Ranking –Language Models – Set Theoretic Models – Probabilistic Models:Generative Model-Probabilistic Ranking Principle-Binary Independence Model-Okapi 25-Bayesian Networks for IR – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

MODULE III **INDEXING** **9 Hours**

Static and Dynamic Inverted Indices – Index Construction and Index Compression-Different Compression Methods: Ziv-Lempel, Variable-Byte, Gamma, Golomb, Gap encoding-Searching – Sequential Searching and Pattern Matching. Query Operations –Query Languages – Query Processing:Query Processing: TAAT, DAAT, WAND, Fagin‟s algorithm – RelevanceFeedback and Query Expansion – Automatic Local and Global Analysis.

MODULE IV **EVALUATION AND PARALLEL INFORMATION RETRIEVAL** 9 Hours

Measuring Effectiveness and Efficiency – Traditional Effectiveness Measures – Statistics in Evaluation – Minimizing Adjudication Effect – Nontraditional Effectiveness Measures – Measuring Efficiency – Efficiency Criteria –Queueing Theory – Query Scheduling – Parallel Information Retrieval – Parallel Query

Processing – MapReduce		
MODULE V	**SEARCHING THE WEB**	**9 Hours**
Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis – XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries		
TOTAL: 45 HOURS		

REFERENCES:

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", (ACM Press Books), Second Edition, 2011
2. Chrstopher D. Manning, PrabhakarRaghavan, HinrichSchutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information RetrievalImplementingand Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
4. https://nptel.ac.in/courses/106101007

2403CP023	FOUNDATION OF DATA SCIENCE	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basic knowledge in probability and calculus

COURSE OBJECTIVES:

1. To introduce students to the theoretical and mathematical foundations of data science
2. Apply the different types of modeling methods for analysis the data
3. To fascinating some of the popular techniques and intellectual ideas of modern day data science
4. Implement data analytics concepts using R.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Analyze the fundamental concepts of data science.
CO2:	Apply fundamental algorithmic ideas to process data.
CO3:	Able to employ methods related to these concepts in a variety of data science applications.
CO4:	Implement the sentiment analysis approach using R language.
CO5:	Identify the purpose of Map Reduce and HDFS.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	-	-	-	-	-	-	2	3
CO2	1	1	2	2	2	1	-	-	-	-	-	-	2	2
CO3	2	1	3	3	3	1	-	-	-	-	-	-	2	3
CO4	3	2	2	1	1	1	-	-	-	-	-	-	2	3
CO5	2	1	1	1	1	1	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO DATASCIENCE**	**9 Hours**

Data science process -roles, stages in data science project -working with data from files -working with relational databases -exploring data -managing data -cleaning and sampling for modeling and validation - introduction to NoSQL.

MODULE II	**MODELING METHODS**	**9 Hours**

Choosing and evaluating models -mapping problems to machine learning, evaluating clustering models, validating models -cluster analysis -K-means algorithm, Naive Bayes -Linear and logistic regression.

MODULE III	**BEST-FIT SUBSPACESS AND and SVD**	**9 Hours**

Introduction, singular vectors, singular value decomposition (SVD), best k-rank approximations, left singular vectors, eigenvectors, applications of SVD.

MODULE IV	**INTRODUCTION TO R**	9 Hours

Reading and getting data into R -ordered and unordered factors -arrays and matrices -lists and data frames -reading data from files -probability distributions -statistical models in R - manipulating objects -data distribution - Sentiment Analysis Approach -Neutral, Negative, Positive Comparative Analysis –Testing in R-test -Test workflow.

MODULE V	**MAP REDUCE**	**9 Hours**

Introduction -distributed file system -algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce -Hadoop - Understanding the Map Reduce architecture - Writing Hadoop Map Reduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

TOTAL: 45 HOURS
REFERENCES:
1.Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", (ACM Press Books), Second Edition, 2011.
2. Avrim Blum, John Hopcroft and Ravindran Kannan, Foundations of Data Science, Cambridge University Press, February 29, 2020, ISBN-13: 978-1108485067.
3. Chrstopher D. Manning, PrabhakarRaghavan, HinrichSchutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008
4. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information RetrievalImplementingand Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
5. https://nptel.ac.in/courses/111104146

2403CP024	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

PREREQUISITE:

Knowledge about DBMS, statistics and linear algebra

COURSE OBJECTIVES:

1. Understand the basic concepts of data mining Familiarize with the data mining functionalities.
2. Assess the strengths and weaknesses of various data mining techniques.
3. Understand the basic concepts of data mining Familiarize with the data mining functionalities.

On the successful completion of the course, students will be able to

CO1:	Evolve multidimensional intelligent model from typical system.
CO2:	Design and implement data warehouse and to do Business Analytics.
CO3:	Acquire knowledge on data and to prepare data for mining
CO4:	Design and deploy classification and clustering techniques.
CO5:	Effective usage of advanced database techniques.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	1	1	-	-	-	-	-	-	2	3
CO2	3	2	2	3	3	-	-	-	-	-	-	-	2	2
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	3	3	3	3	3	1	-	-	-	-	-	-	2	3
CO5	3	3	3	3	3	1	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO DATA WAREHOUSING**	**9 Hours**

Data Warehouse: Basic Concepts - Differences between Operational Database Systems and Data arehouses- Data warehousing Components – Data Warehousing: A Multi-tiered Architecture – Data Warehouse Models: Enterprise Warehouse, Data Mart, distributed and virtual data warehouses - Building a Data warehouse - Data Warehouse and DBMS, - Data Extraction, Cleanup, and Transformation Tools - Data marts, Metadata, Multidimensional data model, Data Warehouse Modeling: Data Cube and OLAP , OLAP operations, Schemas for Multidimensional Database – Metadata

MODULE II	**DATA WAREHOUSE PROCESS AND ARCHITECTURE**	**9 Hours**

A Business Analysis Framework for Data Warehouse Design - Data Warehouse Design Process - Data Warehouse Usage for Information Processing - Data Warehouse Implementation: Efficient Data Cube Computation: Efficient Processing of OLAP, OLAP Server Architectures: ROLAP versus MOLAP versus HOLAP - tuning and testing of data warehouse - data warehouse visualization, Data Warehouse Deployment, Maintenance. Data Warehousing and Business Intelligence Trends.

MODULE III	**INTRODUCTION TO DATA MINING**	**9 Hours**

Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Measuring Data Similarity and Dissimilarity - KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques - Data preprocessing – Data cleaning, Data Integration, Data Transformation and Data Discretization, Data reduction - Association Rule Mining: Frequent Item set Mining Methods – Pattern Evaluation Methods – Association Mining to Correlation Analysis.

MODULE IV	**CLASSIFICATION AND CLUSTERING**	9 Hours

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods(Genetic Algorithms, Rough Set Approach, Fuzzy Set Approaches) – SemiSupervised Classification - Clustering techniques – Partitioning methods : k-means- Hierarchical Methods : distance based agglomerative and divisible clustering, Probabilistic hierarchical Clustering Density-Based Methods : DBSCAN, DENCLUE – Expectation Maximization -Grid Based Methods – Clustering High-Dimensional Data - Clustering Graph and Network Data - Outlier Analysis.		
MODULE V	**TRENDS IN DATA MINING**	**9 Hours**
Big Data - Mining complex data objects – Spatial databases – Temporal databases – Visual and Audio Data Mining – Time series and sequence data – Text mining – Web mining – Data mining Applications.		
	TOTAL: 45 HOURS	

REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei“Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.
2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill, Tenth Reprint, 2007
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014
4. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, Third edition, 2011.
5. Bruce Ratner, “Statistical and Machine - Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data”, CRC Press, Second Edition, 2012.
6. Mehmed kantardzic, “Data mining: Concepts, Models, Methods, and Algorithms”, WileyBlackwell, Second Edition, 2011
7. https://nptel.ac.in/courses/106105174

2403CP025	INTELLIGENT OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

PREREQUISITE:

Knowledge about probability, statistics and Linear algebra

COURSE OBJECTIVES:

1. To impart knowledge on theory of optimization and conditions for optimality for unconstraint and constraint optimization problems
2. To familiarize with the working principle of optimization algorithms used to solve linear and non-linear problems
3. To inculcate modeling skills necessary to describe and formulate optimization problems in machine learning
4. To familiarize with the Modern optimization techniques used in computer vision

On the successful completion of the course, students will be able to

CO1:	Formulate the engineering problems as an optimization problem.
CO2:	Apply necessary and sufficient conditions for a given optimization problem for optimality
CO3:	Select appropriate solution methods and strategies for solving an optimization problem and interpret and analyze the solution obtained by optimization algorithms
CO4:	Justify and apply the use of modern heuristic algorithms for solving optimization problems
CO5:	Solve computer vision based optimization problem using software tools.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	1	-	-	-	-	-	-	-	2	3
CO2	1	2	2	1	1	-	-	-	-	-	-	-	2	2
CO3	1	3	2	1	-	-	-	-	-	-	-	-	2	3
CO4	2	2	2	2	2	-	-	-	-	-	-	-	2	3
CO5	3	3	2	2	3	-	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION AND BASIC CONCEPTS**	**9 Hours**

Classical Optimization Techniques- Numerical Methods of Optimization- Single variable optimization with and without constraint-Multivariate optimization techniques- Multi-objective optimization techniques and evolutionary computing.Case studies.

MODULE II	**OPTIMIZATION TECHNIQUES IN MACHINE LEARNING CLASSICAL OPTIMIZATION**	**9 Hours**

Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy‟s steepest descent method, Newton‟s method, Conjugate gradient method.Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method – Engineering applications of constrained and unconstrained algorithms

MODULE III	**OPTIMIZATION TECHNIQUES IN MACHINE LEARNING**	**9 Hours**

Machine Learning: First order Algorithms-Gradient Descent-Stochastic Optimization Techniques-Evolutionary Algorithms-Meta-heuristic Optimization- Second order Algorithms- Newton‟s Method and Quasi-Newton Methods -Constrained Optimization-Bayesian Optimization-Logistics Regression optimization-Linear Regression optimization.

MODULE IV	**NATURE-INSPIRED OPTIMIZATION**	9 Hours

Evolutionary Algorithms: Genetic Algorithms — Ant colony optimization- Particle Swarm Optimization, – Neural-Network based Optimization – Fuzzy optimization techniques – Applications and performance comparisons all optimization algorithms.		
MODULE V	**MODERN OPTIMIZATION IN COMPUTER VISION**	**9 Hours**
Accelerated Proximal Gradient, ADMM, STAMP & SPADE; Manifold based optimization, L*-norms, Sparse representations and BOVWs, Multiple Kernel Learning (MKL), Latent and Multiple Instance (MI)-learning, Streaming Algorithms		
TOTAL: 45 HOURS		

REFERENCES:

1. Rao S. S. – „Engineering Optimization, Theory and Practice" – New Age International Publishers – 2012 – 4th Edition.
2. Deb K. "Optimization for Engineering Design Algorithms and Examples", PHI – 2000.
3. Arora J." Introduction to Optimization Design", Elsevier Academic Press, New Delhi – 2004.
4. Saravanan R. "Manufacturing Optimization through Intelligent Techniques" Taylor & Francis (CRC Press) – 2006.
5. Hardley G. "Linear Programming", Narosa Book Distributors Private Ltd. – 2002.
6. M.Wahde , " Biologically Inspired Optimization Methods: An Introduction", WIT press
7. https://nptel.ac.in/courses/111105039
8. https://onlinecourses.nptel.ac.in/noc24_ee122/preview

OPEN ELECTIVE COURSES [OEC]

2403CP026	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basics of programming knowledge

COURSE OBJECTIVES:

1. Understand the components and protocols used in IoT.
2. To Understand the IOT Reference Architecture and Real World Design Constraints.
3. Ability to understand the Security requirements in IoT

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Explain the underlying architectures and models in IoT.
CO2:	Analyze different connectivity technologies for IoT.
CO3:	Develop simple applications using Arduino / Raspberry Pi.
CO4:	Apply data analytics techniques to IoT.
CO5:	Study the needs and suggest appropriate solutions for Industrial applications.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	4	-	1	-	-	-	-	-	-	2	3
CO2	3	-	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	-	3	2	-	-	-	-	-	-	-	-	2	3
CO4	3	3	2	3	-	-	-	-	-	-	-	-	2	3
CO5	3	2	2	2	-	2	-	-	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION**	**9 Hours**

Evolution of IoT- IoT Networking Components- Addressing Strategies in IoT- IoT Sensing and Actuation- IoT Processing Topologies and Types-IoT Architectures.

MODULE II	**CONNECTIVITY**	**9 Hours**

Communications Criteria –PHY/MAC layer- Network Layer–Transport Layer –Application Transport Methods– Application Layer-Interoperability in IoT.

MODULE III	**SYSTEM DEVELOPMENT**	**9 Hours**

Design Methodology –Case study –Basic blocks of IoT device- Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to Raspberry Pi.

MODULE IV	**SECURITY IN IoT**	**9 Hours**

Introduction to SDN, SDN for IoT, Data Handling and Analytics, –Big Data Analytics Tools and Technology –Cloud of Things-Edge Streaming Analytics –Network Analytics, Applications. Security history, challenges, variations –Risk Analysis Structures.

MODULE V	**IoT IN INDUSTRY**	**9 Hours**

Cloud Computing, Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.

TOTAL: 45 HOURS

REFERENCES:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017
2. Olivier Hersent, David Boswarthick, Omar Elloum, “The Internet of Things Key applications and Protocols”, Wiley, 2012
3. Michael Miller, “The Internet of Things”, Pearson Education, 2015.
4. ArshdeepBahga, Vijay Madisetti, “Internet of Things –A hands-on approach”, Universities Press, 2015
5. Jan Ho¨ller , VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle,"From Machine -to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014
6. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011
7. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly(SPD), 2014
8. SudipMisra, ChandanaRoyandAnandarup Mukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press.
9. https://nptel.ac.in/courses/106105166

2403CP027	ETHICAL HACKING AND APPLIED CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

PREREQUISITE:

Computer Networking, Cryptography

COURSE OBJECTIVES:

1. To understand and analyse Information about the basics of ethical hacking
2. To study the various techniques for system cracking
3. To understand the concept of malwar and its types
4. To analyze the mechanisms for prevention of attacks
5. To understand the attacks in various application areas

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Describe and understand the basics of the ethical hacking
CO2:	Demonstrate the techniques for system hacking
CO3:	Characterize the malware and their attacks and detect and prevent them
CO4:	Determine the signature of different attacks and prevent them
CO5:	Detect and prevent the security attacks in different environments

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	-	3	3	-	-	-	2	3
CO2	3	3	3	2	3	3	-	3	3	-	-	-	2	2
CO3	3	3	3	3	3	3	-	3	3	-	-	-	2	3
CO4	3	3	3	3	3	3	-	3	3	-	-	-	2	3
CO5	3	3	3	3	3	3	-	2	2	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION**	**9 Hours**

An Introduction to ethical Hacking : Security Fundamental, Security testing, Hacker and Cracker, Descriptions, Test Plans-keeping It legal, Ethical and Legality. The Technical Foundations of Hacking: The Attacker‟s Process, The Ethical Hacker‟s Process, Security and the Stack

MODULE II	**SYSTEM HACKING**	**9 Hours**

Footprinting and scanning : Information Gathering, Determining the Network Range, Identifying Active Machines, Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping the Network Attack Surface. Enumeration and System Hacking : Enumeration, System Hacking,

MODULE III	**THREATS**	**9 Hours**

Malware Threats : Viruses and Worms, Trojans, Covert Communication, Keystroke Logging and Spyware, Malware Counter measures. Sniffers, Session Hijacking and Denial of Service : Sniffers, Session Hijacking, Denial of Service and Distributed Denial of Service

MODULE IV	**WEB SERVER HACKING AND ATTACKING**	**9 Hours**

Web Server Hacking, Web Applications and Database Attacks: Web Server Hacking, Web Application Hacking, Database Hacking Wireless Technologies, Mobile Security and Attacks : Wireless Technologies, Mobile Device Operation and Security, Wireless LANs

MODULE V	**HONEYPOTSAND BOTNETS**	**9 Hours**

IDS, Firewalls and Honeypots : Intrusion Detection Systems, Firewalls, Honeypots . Physical Security and Social Engineering: Physical Security, Social Engineering. Cloud Computing and Botnets: Cloud Computing, Botnets

TOTAL: 45 HOURS

REFERENCES:

1. https://hackaday.com/
2. https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/
3. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
4. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
5. RajatKhare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2006
6. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner‟s Guide (3rd ed.). Packt Publishing, 2011
7. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

2403CP028	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basic knowledge about computer networks

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Work on the internals components of the social network
CO2:	Model and visualize the social network
CO3:	Mine the behaviour of the users in the social network
CO4:	Predict the possible next outcome of the social network
CO5:	Apply social network in real time applications

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	2	-	2	-	-	-	-	2	3
CO2	3	3	-	2	3	3	2	2	-	-	-	-	2	2
CO3	1	1	-	-	3	3	3	3	-	-	-	-	2	3
CO4	3	3	3	3	3	3	-	3	-	-	-	-	2	3
CO5	3	3	-	-	-	-	3	3	-	-	-	-	2	3

COURSE CONTENTS:

MODULE I	**INTRODUCTION**	**9 Hours**

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

MODULE II	**MODELING AND VISUALIZATION**	**9 Hours**

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

MODULE III	**MINING COMMUNITIES**	**9 Hours**

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks

MODULE IV	**EVOLUTION**	**9 Hours**

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

MODULE V	**REAL TIME APPLICATIONS**	**9 Hours**
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection		
	TOTAL: 45 HOURS	

REFERENCES:

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, ―Computational Social Network Analysis: Trends, Tools and Research Advances‖, Springer, 2012.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, Springer, 1 st edition, 2011.
3. Charu C. Aggarwal, ―Social Network Data Analytics‖, Springer; 2014.
4. Giles, Mark Smith, John Yen, ―Advances in Social Network Mining and Analysis‖, Springer, 2010.
5. Guandong Xu , Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, Springer, 1st edition, 2012.
6. Peter Mika, ―Social Networks and the Semantic Web‖, Springer, 1st edition, 2007.
7. Przemyslaw Kazienko, Nitesh Chawla,‖Applications of Social Media and Social Network Analysis‖, Springer,2015
8. https://nptel.ac.in/courses/106106239

2403CP029	CYBER FORENSICS	L	T	P	C
		3	0	0	3

PREREQUISITE:

Computer Networks, Operating System and Malware Analysis

COURSE OBJECTIVES:

1. To become familiar with forensics tools.
2. To learn to analyze and validate forensics data
3. To understand the basics of forensics tools
4. To study the various hacking techniques in forensics
5. To learn the techniques of web hacking

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Understand the basic terminology of cybercrimes
CO2:	Apply a number of different computer forensic tools to a given scenario
CO3:	Analyze and validate the basics of computer forensics
CO4:	Understand the concepts of ethical hacking
CO5:	Analyze methods of hacking in web security.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO2	-	-	-	3	3	3	-	-	-	-	-	3	2	2
CO3	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO4	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO5	-	-	-	3	3	3	-	-	-	-	-	3	2	3

COURSE CONTENTS:

MODULE I **INTRODUCTION** **9 Hours**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition

MODULE II **CYBERCRIME TOOLS** **9 Hours**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

MODULE III ANALYSIS AND VALIDATION **9 Hours**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

MODULE IV **HACKING** **9 Hours**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing

MODULE V WEB HACKING **9 Hours**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers – Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 HOURS

REFERENCES:

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. John R.Vacca, ―Computer Forensics, Cengage Learning, 2005.
4. MarjieT.Britz, ―Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013
5. AnkitFadia ― Ethical Hacking, Second Edition, Macmillan India Ltd, 2006.
6. Kenneth C.Brancik ―Insider Computer Fraud‖ Auerbach Publications Taylor & Francis Group–.2008
7. https://nptel.ac.in/courses/106106178

2403CP030	SOCIAL MEDIA WEN ANALYSIS	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basic knowledge of social media platforms and analytics tools

COURSE OBJECTIVES:

1. To study the evolution of social media communities
2. To get the idea of making the social media as business.
3. To understand the basics of tracking in social media
4. To analyze the web and web data analytics strategies
5. To get the idea OF SEO

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Enhance the social media skills.
CO2:	Develop a mass communication strategy and guide campaigns.
CO3:	Get an idea of social media policies.
CO4:	Understand the fundamentals and concepts of web analytics.
CO5:	Effectively use the resulting insights to support website design decisions, campaign optimization, search analytics, etc

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO2	-	-	-	3	3	3	-	-	-	-	-	3	2	2
CO3	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO4	-	-	-	3	3	3	-	-	-	-	-	3	2	3
CO5	-	-	-	3	3	3	-	-	-	-	-	3	2	3

COURSE CONTENTS:

MODULE I **INTRODUCTION** **9 Hours**

Evolution of online communities - History and Evolution of Social Media- Social Media vs. Traditional media - Social Media Audience and Goals for using Social Media - Understanding Social Media: Strong and weak ties – Influencers - How ideas travel – Viralness - Social theory and social media - technological determinism in popular discourse on social media technologies

MODULE II **COMMUNITY BUILDING AND MANAGEMENT** **9 Hours**

Science of Social Media - Keys to Community Building - Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media-Digital PR-Encourage Positive Chatter in Social Media - Identity in social media: formation of identities, communities, activist movements, and consumer markets - Social Media as business.

MODULE III **SOCIAL MEDIA POLICIES** **9 Hours**

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The road ahead in social media- The Basics of Tracking Social Media - social media analytics- Insights Gained From Social Media- Customized Campaign Performance Reports - Observations of social media use

MODULE IV **WEB ANALYTICS**

Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis

MODULE V **SEARCH ANALYTICS** **9 Hours**

Search engine optimization (SEO), non-linear media consumption, user engagement, user generated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors.
TOTAL: 45 HOURS
REFERENCES:
1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
5. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and Café Press, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016.

2403CP031	KNOWLEDGE ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

PREREQUISITE:

A basic knowledge about knowledge based systems.

COURSE OBJECTIVES:

1. To understand the concepts of Knowledge Engineering.
2. To explain logic based reasoning.
3. To understand Reasoning under uncertainty
4. To understand the importance of Knowledge management and its different types in practice
5. To know the benchmark and different organizational approaches and technical platforms and to set up a first step approach to introduce KM in practice.•

On the successful completion of the course, students will be able to

CO1:	Analyze the tools for knowledge acquisition and sharing
CO2:	Evaluate reasoning and frame rules in production system.
CO3:	Apply uncertainty and degrees of belief for solving the problem
CO4:	Evaluate various Techniques of Knowledge Management with different scenario.
CO5:	Discuss the design of prototype and distributed architecture.

COs Vs POs & PSOs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	2	2	-	-	-	-	-	2	1	3
CO2	2	3	3	3	2	2	-	-	-	-	-	2	1	2
CO3	2	2	3	3	2	2	-	-	-	-	-	2	1	3
CO4	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO5	3	1	3	3	2	2	-	-	-	-	-	2	1	3

COURSE CONTENTS:

MODULE I **INTRODUCTION** **9 Hours**

Key concepts – Why knowledge Representation and Reasoning – Language of first order Logic – Syntax, Semantics Pragmatics – Expressing Knowledge – Levels of Representation – Knowledge Acquisition and Sharing – Sharing Ontology – Language Ontology –Language Patterns – Tools for Knowledge Acquisition

MODULE II **RESOLUTION AND REASONING** **9 Hours**

Proportional Case – Handling Variables and Qualifies: first order case ,Answer extraction, Equality – Dealing with Intractability – Reasoning with Horn Clauses - Procedural Control of Reasoning: algorithm design, Specifying goal order – Rules in Production – Description Logic - Vivid Knowledge – Beyond Vivid.

MODULE III DEFAULTS, UNCERTAINTY AND EXPRESSIVENESS **9 Hours**

Defaults – Introduction – Closed World Reasoning – Circumscription – Default Logic Limitations of Logic – Fuzzy Logic – Nonmonotonic Logic – Theories and World – Semiotics – Auto epistemic Logic - Vagueness – Uncertainty and Degrees of Belief – Noncategorical Reasoning – Objective and Subjective Probability

MODULE IV **TECHNIQUES OF KNOWLEDGE MANAGEMENT** **9 Hours**

Knowledge Elicitation Techniques – Characteristics – Elicitation scenario – Modeling Communication Aspects – Communication plan – Case study – Information exchange – Validation and Balancing – Knowledge Management and Organizational Learning – Case study: Organizational model – Task model – Agent model.

MODULE V KNOWLEDGE SYSTEM IMPLEMENTATION **9 Hours**

Case Studies – Designing Knowledge Systems Structure preserving design – Design of prototypes – Distributed architectures – Knowledge Codification – Testing and Deployment – Knowledge Transfer and Knowledge Sharing – Knowledge System Implementation: Implementation in Prolog – Implementation in Aion
TOTAL: 45 HOURS
REFERENCES:
1. Ronald Brachman, Hector Levesque "Knowledge Representation and Reasoning ", The Morgan Kaufmann Series in Artificial Intelligence 2004
2. John F. Sowa, " Knowledge Representation: Logical, Philosophical, and Computational Foundations", 2000
3. Arthur B. Markman, "Knowledge Representation", Lawrence Erlbaum Associates,1998
4. Guus Schreiber, Hans Akkermans, AnjoAnjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2001.
5. Elias M.Awad& Hassan M. Ghaziri, "Knowledge Management", Pearson Education, 2003

2404CP301	**PROJECT WORK–PHASE I**	**L**	**T**	**P**	**C**
		0	**0**	**20**	**10**

PREREQUISITE:

Identifying the project's need, defining high-level objectives, conducting a feasibility study to confirm viability, identifying key stakeholders, and creating a business case or project charter to outline the project's purpose, goals, scope, and constraints

COURSE OBJECTIVES:

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations

COURSE OUTCOMES:

CO1:	Model and solve real world problems by applying knowledge across domains.
CO2:	Develop products, processes or technologies for sustainable and socially relevant applications
CO3:	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks.
CO4:	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms.
CO5:	Identify technology/research gaps and propose innovative/creative solutions.
CO6:	Organize and communicate technical and scientific findings effectively in written and oral forms.

COs Vs POs MAPPING:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	2	2	2	1	1	1	1	2	2	3
CO2	2	2	2	-	1	3	3	1	1	-	1	1	2	3
CO3	-	-	-	-	-	-	-	-	-	2	2	1	2	3
CO4	-	-	-	-	2	-	-	3	3	2	3	2	2	3
CO5	2	3	3	1	2	-	-		2	-	-	1	2	3
CO6	-	-	-	-	2	-	-	2	2	3	1	1	2	3

LIST OF EXPERIMENTS:

Phase 1 Target

1. Literature study/survey of published literature on the assigned topic
2. Formulation of objectives
3. Formulation of hypothesis/ design/ methodology
4. Formulation of work plan and task allocation.
5. Block level design documentation
6. Seeking project funds from various agencies
7. Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study

8. Preparation of Phase 1 report
TOTAL: 30 HOURS
Evaluation Guidelines & Rubrics
Total: 100 marks (Minimum required to pass: 50 marks).
➢ Project progress evaluation by guide: 30 Marks.
➢ Interim evaluation by the Evaluation Committee: 20 Marks.
➢ Final Evaluation by the Evaluation Committee: 30 Marks.
➢ Project Phase - I Report (By Evaluation Committee): 20Marks.
(The evaluation committee comprises HoD or a senior faculty member, Project coordinator
and project supervisor).