SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603203.

(Approved by AICTE, Affiliated to Anna University, 'A' Grade Accredited by NAAC, NBA Accredited, ISO 9001:2015 Certified)

POST GRADUATE

CURRICULA AND SYLLABI

M.Tech. – DATA SCIENCE

REGULATION 2023

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution, Affiliated to Anna University, Chennai)
M.TECH. DATA SCIENCE
REGULATION – 2023

1. PROGRAMME EDUCATION OBJECTIVES (PEOs):

1. To prepare the students to be employed in industry, government and entrepreneurial endeavors to have a successful professional career.
2. To pursue higher education and /or research.
3. To utilize the acquired technical skills and knowledge for the benefit of society.
4. To work collaboratively on multidisciplinary projects and exhibit high levels of professional and ethical values within the organization and society at large.
5. To become entrepreneurs and show their leadership and technical skills to develop innovative solutions to address the challenges of a sustainable ecosystem.

2. PROGRAMME OUTCOMES (POs):

After going through the two years of study, Master of Technology in Data Science Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**	Design solutions for the complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including the design of experiments, analysis and interpretation of data, and the synthesis of the information to provide valid conclusions.

PO5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. PROGRAMME SPECIFIC OUTCOMEs (PSOs)

1. Design and analyze a next generation data security based on machine learning algorithms using Deep Learning techniques.
2. Design and develop advanced storage structures, data preprocessing, optimization and visualization techniques for in depth understanding of the technologies in data science and business analytics.
3. Design, plan and install research and computational technologies using latest hardware and software components that would be helpful in contemporary business environments.
4. Design a data analytics model with indispensable data science engineering to unravel solutions for emerging Artificial Intelligence, IoT and Big Data problems using statistical analyse with professional statistical software.

4. PEO/PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES												PROGRAM SPECIFIC OUTCOMES			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
I	3	3											3	3	3	
II			3		3	3	3		2					3		
III			3	3	3	3					1	2			3	3
IV												2	3			
V								3		3			3	3	3	3

Contribution: 1-Reasonable, 2- Significant, 3-Strong

MAPPING M.TECH. - DATA SCIENCE

Year	Sem	Subject Code and Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
I	I	MA3126-Advanced Mathematics for Data Science	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
		DS3161-Python for Data Science	3	-	3	2	2.3	2	2	-	-	-	2	-	2	-	3	-
		DS3162-Machine Learning	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
		CP3161-Advanced Data Structures and Algorithms	3	2.3	2	2	-	-	-	-	-	-	-	-	-	2	2	2
		CP3162-Database Practices	2.7	2.5	2.5	2	2.3	1	1	-	2	-	1.5	-	2	2.5	2	1
		DS3163-Data Mining	3	-	3	3	2	-	-	-	-	-	-	-	-	2.2	-	1.5
		DS3164-Python for Data Science Laboratory	3	3	3	1.2	-	-	-	-	1	-	-	1.5	1.2	1.4	-	1
		DS3165-Machine Learning Laboratory	3	3	3	1	-	1	-	-	1	-	-	2	1	1	-	1
I	II	MA3223-Statistical Learning for Data Science	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
		DS3261-Data Preprocessing and optimization Techniques	2	2	2	2	2	-	-	-	-	-	-	-	-	3	-	-
		DS3262-Advanced Data Visualization Techniques	2	3	2.6	2	2	-	2	2	-	-	1.5	-	-	-	-	2
		DS3263-Big Data Mining and Analytics	3	3	3	2	2	1	-	-	-	-	-	-	3	3	2	-
		DS3264-Deep Learning	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2	-
		DS3265-Data Visualization Laboratory	2	3	3	-	2	-	2	-	-	3	3	2	-	-	3	2
		DS3241-Mini Project																
II	III	DS3341-Project Work Phase-I																
II	IV	DS3444- Project Work Phase - II																

Professional Electives

Year	Sem	Subject Code and Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	II	PDS101-DevOps and Micro services	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-	-
		PDS102-Mobile Application Development	2.4	2.4	1.8	2.2	2	3	-	-	-	-	-	-	-	-	-	-
		PDS103-Web Development Framework	2	1.2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
		PDS104-Web Design and Management	2	1	2.6	3	2.6	2	-	-	-	-	-	-	2	2	3	-
		PDS105-Web Analytics	3	3	-	-	2	-	-	-	-	-	-	-	3	2	-	-
II	III	PDS201-Ethics and AI	3	3	3	2.2	-	-	-	2	-	-	-	-	2	2.2	2.6	-
		PDS202-Modern Cryptography and Crypto currency	2.2	3	3	3	2	-	-	-	-	-	-	-	2.2	-	2	-
		PDS203-Social Network Security	3	3	2.2	3	-	-	-	-	-	-	-	-	-	2.2	-	-
		PDS204-Blockchain Technologies	3	3	3	3	-	-	-	-	-	-	-	-	2	2	1.6	2
		PCP3221-Information Retrieval Techniques	3	1	3	2	3	2	1	2	2	3	2	2	2	2	2	2
II	III	PDS301-Augmented Reality/Virtual Reality	3	3	3	3	2	-	-	-	-	-	-	-	2.2	2.2	-	2
		PDS302- 3D Printing Technologies	3	3	3	3	2	-	-	-	-	-	-	-	2.2	2.2	-	2
		PDS303-Robotic Process Automation	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
		CP3262- Cloud Computing Technologies	2	3	3	2	-	2	2	3	-	-	-	-	2	3	2	2
		CP3261-Internet of Things	2.4	2	2.5	2	3	-	-	2	2	3	-	-	3	3	2	2

SRM VALLIAMMAI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

M. Tech. DATA SCIENCE

CURRICULUM FOR SEMESTER I TO IV

SEMESTER: I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA3126	Advanced Mathematics for Data Science	BSC	4	4	0	0	4
2	DS3161	Python for Data Science	PCC	3	3	0	0	3
3	DS3162	Machine Learning	PCC	3	3	0	0	3
4	CP3161	Advanced Data Structures and Algorithms	PCC	3	3	0	0	3
5	CP3162	Database Practices	PCC	3	3	0	0	3
6	DS3163	Data Mining	PCC	3	3	0	0	3
PRACTICALS								
7	DS3164	Python for Data Science Laboratory	PCC	3	0	0	3	1.5
8	DS3165	Machine Learning Laboratory	PCC	3	0	0	3	1.5
			TOTAL	**25**	**19**	**0**	**6**	**22**

SEMESTER: II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA3223	Statistical Learning for Data Science	BSC	4	4	0	0	4
2	DS3261	Data Preprocessing and optimization Techniques	PCC	3	3	0	0	3
3	DS3262	Advanced Data Visualization Techniques	PCC	3	3	0	0	3
4	DS3263	Big Data Mining and Analytics	PCC	3	3	0	0	3
5	DS3264	Deep Learning	PCC	3	3	0	0	3
6	PDSXXX	Professional Elective -I	PEC	3	3	0	0	3
PRACTICALS								
7	DS3265	Data Visualization Laboratory	PCC	3	0	0	3	2
8	DS3241	Mini Project	EEC	3	0	0	3	2
			TOTAL	**25**	**19**	**0**	**6**	**23**

SEMESTER: III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	BA3371	Research Methodology and IPR	RMC	3	3	0	0	3
2	PDSXXX	Professional Elective - II	PEC	3	3	0	0	3
3	PDSXXX	Professional Elective - III	PEC	3	3	0	0	3
PRACTICALS								
4	DS3341	Project Work Phase-I	EEC	12	0	0	12	6
5	DS3342	Internship (4 Weeks)	EEC	0	0	0	0	2
6	DS3343	Technical Seminar	EEC	0	0	0	0	1
TOTAL				**21**	**9**	**0**	**12**	**18**

SEMESTER: IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1	DS3444	Project Work Phase - II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS: 75

PROFESSIONAL ELECTIVES COURSES (PEC)

ELECTIVES-I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	PDS101	DevOps and Micro services	PEC	3	3	0	0	3
2	PDS102	Mobile Application Development	PEC	3	3	0	0	3
3	PDS103	Web Development Framework	PEC	3	3	0	0	3
4	PDS104	Web Design and Management	PEC	3	3	0	0	3
5	PDS105	Web Analytics	PEC	3	3	0	0	3

ELECTIVES-II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	PDS201	Ethics and AI	PEC	3	3	0	0	3
2	PDS202	Modern Cryptography and Crypto currency	PEC	3	3	0	0	3
3	PDS203	Social Network Security	PEC	3	3	0	0	3
4	PDS204	Blockchain Technologies	PEC	3	3	0	0	3
5	PCP3221	Information Retrieval Techniques	PEC	3	3	0	0	3

ELECTIVES-III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	PDS301	Augmented Reality/Virtual Reality	PEC	3	3	0	0	3
2	PDS302	3D Printing Technologies	PEC	3	3	0	0	3
3	PDS303	Robotic Process Automation	PEC	3	3	0	0	3
4	CP3262	Cloud Computing Technologies	PEC	3	3	0	0	3
5	CP3261	Internet of Things	PEC	3	3	0	0	3

CATEGORY

BASIC SCIENCE COURSE (BSC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA3126	Advanced Mathematics for Data Science	BSC	4	4	0	0	4
2	MA3223	Statistical Learning for Data Science	BSC	4	4	0	0	4

PROFESSIONAL CORE COURSES (PCC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	DS3161	Python for Data Science	PCC	3	3	0	0	3
2	DS3162	Machine Learning	PCC	3	3	0	0	3
3	CP3161	Advanced data Structures and Algorithms	PCC	3	3	0	0	3
4	CP3162	Databases Practices	PCC	3	3	0	0	3
5	DS3163	Data Mining	PCC	3	3	0	0	3
6	DS3164	Python for Data Science Laboratory	PCC	3	0	0	3	1.5
7	DS3165	Machine Learning Laboratory	PCC	3	0	0	3	1.5
8	DS3261	Data Preprocessing and optimization Techniques	PCC	3	3	0	0	3
8	DS3262	Advanced Data Visualization Techniques	PCC	3	3	0	0	3
9	DS3263	Big Data Mining and Analytics	PCC	3	3	0	0	3
10	DS3264	Deep Learning	PCC	3	3	0	0	3
10	DS3265	Data Visualization Laboratory	PCC	3	0	0	3	2

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	BA3371	Research Methodology and IPR	RMC	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	DS3241	Mini Project with Research Paper Writing	EEC	3	0	0	3	2
2	DS3341	Project Work Phase-I	EEC	12	0	0	12	6
3	DS3342	Internship (4 Weeks)	EEC	0	0	0	0	2
4	DS3343	Technical Seminar	EEC	0	0	0	0	1
5	DS3344	Project Work Phase- II	EEC	24	0	0	24	12

SUMMARY

S. No.	SUBJECT CATEGORY	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	FC	4	4	0	0	8
2	PCC	18	14	0	0	32
3	PEC	0	3	6	0	9
4	RMC	0	0	3	0	3
5	EEC	0	2	9	12	23
TOTAL		22	23	18	12	75

ABBREVIATIONS:

BSC - BASIC SCIENCE COURSE

PCC - PROFESSIONAL CORE COURSES

PEC - PROFESSIONAL ELECTIVE COURSES

RMC - RESEARCH METHODOLOGY AND IPR COURSES

EEC - EMPLOYABILITY ENHANCEMENT COURSES

SEMESTER – I

MA3126	ADVANCED MATHEMATICS FOR DATA SCIENCE	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To understand and apply matrix techniques for engineering applications.
- To familiarize the student with basic concepts of Graph Theory: Isomorphism.
- To understand the basic concepts of Combinatorics.
- To solve the problems in Formulation of optimization problems, convex set, convex functions, convex optimization.
- To acquaint the student with mathematical tools needed in evaluating search methods for Multivariable unconstrained problems.

UNIT–I: MATRIX THEORY 12

Eigen values, Eigen vectors, and Diagonalization, singular value decomposition. Positive definite Matrices-Minima, Maxima and saddle points, Test of Positive definiteness, semi-definite and indefinite Matrices.

UNIT–II: GRAPH THEORY 12

Graphs and graph models – Graph terminology and special types of graphs - Graph Isomorphism-Planar graphs -graph coloring-Hamilton circuits and Euler cycles.

UNIT–III: COMBINATORICS 12

The pigeonhole principle – Permutations and combinations - Permutations and Combinations with and without repetition- Specialized techniques to solve combinatorial enumeration problems - Inclusion and exclusion principle and its applications

UNIT–IV: SINGLE VARIABLE OPTIMIZATION TECHNIQUES 12

Introduction-Formulation of optimization problems, classification of optimization problems-overview of analytical solution for unconstrained optimization problems- constrained optimization-convex set-convex functions-convex optimization problem- search methods – Overview of single variable search methods.

UNIT–V: MULTI – VARIABLE OPTIMIZATION TECHNIQUES 12

Search methods for Multivariable unconstrained problems - Kuhn- Tucker conditions- Optimality criteria-direct search methods- evolutionary search method, Hook-Jeeves pattern search method, gradient based methods –Cauchy's steepest descent method, Newton's method.

TOTAL: 60 PERIODS

OUTCOMES:

- To apply the idea of reducing complex problems into simple form using matrix Technique.
- This course equips the students to have basic knowledge and understanding of Graph isomorphism.
- Have an understanding in counting principle on many levels of Combinatorics.
- To apply the concept of Formulation of optimization problems, convex set, convex functions, convex optimization.
- Basic application of mathematical tools needed in evaluating search methods for multivariable unconstrained problems.

REFERENCES:

1. Gilbert Strang, Linear Algebra and its Applications, Fourth Edition, Cambridge University Press. 2009.
2. Howard Anton and Chris Rorrers," Elementary Linear Algebra", Tenth Edition, 2010 John Wiley & Sons, Inc.
3. Kalyanmoy Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice Hall of India, New Delhi, 2004.
4. S.S. Rao, "Optimization Theory and Applications", Second Edition, New Age International (P) Limited Publishers, 1995
5. M. Asghar Bhatti, "Practical Optimization Methods: with Mathematics Applications", Springer Verlag Publishers, 2000.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

DS3161 PYTHON FOR DATA SCIENCE L T P C

3 0 0 3

OBJECTIVES:

- To understand the data science fundamentals and process.
- To impart necessary knowledge of the Mathematical foundations
- Be familiar with basic concepts on Machine Learning
- Learn the different classification algorithms for appropriate decision making.
- To learn the tools to implement Data science and its application.

UNIT – I: INTRODUCTION TO DATA SCIENCE 9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT - II: MATHEMATICAL FOUNDATIONS 9

Linear Algebra: Vectors, Matrices- Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox-Correlation and Causation- Probability: Dependence and Independence, Conditional Probability, Bayes's-Theorem, Random Variables-Continuous Distributions- The Normal Distribution-The Central Limit Theorem.

UNIT - III: MACHINE LEARNING 9

Overview of Machine learning concepts –Types of Machine learning - Linear Regression-model assumptions-Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression- Support Vector Machines (SVM), Decision Trees, And Random Forest.

UNIT - IV: PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT - V: PYTHON FOR DATA VISUALIZATION 9

Visualization with matplot lib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting –

geographic data – data analysis using stat models and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

TOTAL: 45 PERIODS

OUTCOMES:

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

- Define the data science process
- Demonstrate understanding of the mathematical foundations needed for data science.
- Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees.
- Build data science applications using Python based toolkits.
- Familiar in Data science applications and implementation.

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media First edition (April 30, 2015) (Unit II, III)
3. Python Data Science Hand book – Jake vanderplas, 2017, 1st edition, O’Rielly books (Unit IV, V)

REFERENCE BOOKS:

1. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, Second Edition, 2009.
2. G. Strang (2016). Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-
CO 2	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 3	-	-	-	2	-	-	-	-	-	-	2	-	-	-	3	-
CO 4	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	2	2	2	-	-	-	2	-	-	-	-	-

Average	3	-	3	2	2.3	2	2	-	-	-	2	-	2	-	3	-

DS3162 **MACHINE LEARNING** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT – I: **INTRODUCTION AND MATHEMATICAL FOUNDATIONS** **9**

What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory

UNIT - II: **SUPERVISED LEARNING** **9**

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

UNIT - III: **UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING** **9**

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems – EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning.

UNIT - IV: **PROBABILISTIC METHODS FOR LEARNING** **9**

Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks –

Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models

UNIT - V: NEURAL NETWORKS AND DEEP LEARNING 9

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward

Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand and outline problems for each type of machine learning
- Design a Decision tree and Random Forest for an application
- Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.
- Use a tool to implement typical Clustering algorithms for different types of applications.
- Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

TEXT BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.

REFERENCE BOOKS

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
CO 2	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 3	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 4	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2

CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
Average	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2

CP3161 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C

3 0 0 3

OBJECTIVES:

- To extend the students' knowledge of algorithms and data structures.
- To enhance their expertise in algorithmic analysis and algorithm design techniques.
- To understand various types of search and heap structures.
- To study various types of geometric, randomized and approximation algorithms.
- To extrapolate from them in order to apply those algorithms and techniques to solve problems.

UNIT I FUNDAMENTALS 9

Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Introduction to NP-Completeness/NP-Hard – Recurrence Equations – Solving RecurrenceEquations — Time-Space Tradeoff.

UNIT II SEARCH STRUCTURES 9

Binary Search Trees – AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees – Splay Trees – Tries.

UNIT III HEAP STRUCTURES 9

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps – LazyBinomial Heaps

UNIT IV GEOMETRIC ALGORITHMS 9

Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection – Computingthe Overlay of Two Subdivisions – Range Trees – Voronoi Diagram

UNIT V ADDITIONAL TOPICS 9

Approximation Algorithms: Vertex Cover & Euclidean Travelling Salesperson Problem – Randomized Algorithms: Closest Pair Problem & Minimum Spanning Trees – Online Algorithm:

Euclidean SpanningTree.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student will be able to
- Analyze algorithms.
- Determine algorithm correctness.
- Choose appropriate data structures for the problems to be solved.
- Design algorithms for problems from different domains and identify various research strategies on algorithmic design.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”,Second Edition, University Press, 2008.
2. Gilles Brassard, Paul Bratley, “Algorithmics: Theory and Practice”, Prentice Hall, 1988.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, “Computational Geometry Algorithms and Applications”, Third Edition, Springer, 2008.
4. R.C.T Lee, S.S Tseng, R.C Chang and Y.T Tsai, “Introduction to the Design and Analysis of Algorithms”, Tata McGraw-Hill Edition, 2012.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, MIT Press, 2009.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO 4	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
Average	3	2.3	2	2	-	-	-	-	-	-	-	-	-	2	2	2

CP3162 DATABASE PRACTICES L T P C

3 0 0 3

COURSE OBJECTIVES

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Understand query processing in a distributed database system
- Understand the basics of XML and create well-formed and valid XML documents.
- Distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications inreal time world to protect the database and information associated with them.

UNIT I RELATIONAL DATA MODEL 9

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY 9

Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.

UNIT III XML DATABASES 9

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying — XPath — XQuery

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS 9

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systemsand MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQLKey-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store

– Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage andDistributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

UNIT V DATABASE SECURITY 9

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security –SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.
- Understand and write well-formed XML documents
- Be able to apply methods and techniques for distributed query processing.
- Design and Implement secure database systems.
- Use the data control, definition, and manipulation languages of the NoSQL databases

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2019.
3. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006
4. Raghu Ramakrishnan, Johannes Gehrke “Database Management Systems”, Fourth Edition, McGraw Hill Education, 2015.
5. Harrison, Guy, “Next Generation Databases, NoSQL and Big Data” , First Edition, Apress publishers, 2015
6. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Sixth Edition, Pearson Education, 2015

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3	-	3	-	2	-	1	-	-	-	-	-	2	-	-	-
CO 2	3	3	-	-	2	-	-	-	-	-	2	-	-	3	-	-
CO 3	2	1	-	2	3	-	-	-	-	-	-	-	-	2	-	-
CO 4	-	-	2	-	-	1	-	-	-	-	1	-	-	-	2	-
CO 5	-	3	-	-	-		-	-	2	-	-	-	-	-	-	1
Average	2.7	2.5	2.5	2	2.3	1	1	-	2	-	1.5	-	2	2.5	2	1

DS3163 **DATA MINING** **L T P C**

3 0 0 3

OBJECTIVES:

- Identify the scope and necessity of Data Mining algorithms.
- To understand about Association rules and Classification Methods
- To understand various tools of Data Mining and techniques to solve the real time problems.
- To understand about clustering techniques and its different methods
- To analyze about Outlier detection and its methods

UNIT – I INTRODUCTION TO DATA MINING AND PREPROCESSING 9

Data mining - Related technologies - Machine Learning, DBMS, OLAP, Statistics - Data MiningGoals - Stages of the Data Mining Process - Data Mining Techniques - Knowledge Representation Methods – Applications.Data preprocessing- Data cleaning- Data transformation - Data reduction - Discretization and generating concept hierarchies.

UNIT – II CLASSIFICATION ALGORITHMS I 9

Association rules: Basic idea: item sets - Generating item sets and rules efficiently - Correlation analysis. Classification: Basic learning/mining tasks - Inferring rudimentary rules: 1R algorithm - Decision trees - Bayes Classification Methods - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy.

UNIT – III CLASSIFICATION ALGORITHMS II 9

Bayesian Belief Networks - Classification by Back propagation - Support Vector Machines - Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers - Case-Based Reasoning- Multiclass Classification - Semi-Supervised Classification- Mining Time series Data, Periodicity Analysis for time related sequence data.

UNIT - IV CLUSTERING 9

Basic issues in clustering - First conceptual clustering system: Cluster/2 - Partitioning methods: k-means, expectation maximization (EM) - Hierarchical methods: distance-based agglomerative and divisible clustering - Conceptual clustering: Cobweb.

UNIT - V OUTLIER DETECTION 9

Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the techniques for data pre processing
- Apply association rules algorithm for correlation analysis
- Apply decision tree algorithm for classification
- Apply Bayesian networks algorithm for classification
- Apply various clustering algorithms for different datasets

TEXT BOOKS:

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Fourth Edition), Morgan Kaufmann, 2016.
2. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining Concepts and Techniques”, Morgan Kaufman Publications, Third Edition, 2011.

REFERENCE BOOKS:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar,” Introduction Data Mining”, Pearson, 2016
2. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata McgrawHill, 2004.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	3	3	2	-	-	-	-	-	-	-	-	3	-	2
CO 2	3	-	3	3	2	-	-	-	-	-	-	-	-	2	-	1
CO 3	3	-	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO 4	3	-	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO 5	3	-	3	3	2	-	-	-	-	-	-	-	-	2	-	-
Average	3	-	3	3	2	-	-	-	-	-	-	-	-	2.2	-	1.5

DS3164	PYTHON FOR DATA SCIENCE LABORATORY	L T P C 0 0 3 1.5

OBJECTIVES:

- To develop a basic understanding of import data sets for various analytical purposes.
- To utilize the various packages available visualization, reporting, data manipulation, and statistical analysis.
- To create interactive business applications that allow for data querying and data exploration.
- To collect, explore, clean, munge and manipulate data.
- To build data science applications using Python based toolkits.

LIST OF EXPERIMENTS:

1. Write a program in Python to predict the class of the flower based on available attributes.
2. Write a program in Python to predict if a loan will get approved or not.
3. Write a program in Python to predict the traffic on a new mode of transport.
4. Write a program in Python to predict the class of user.
5. Write a program in Python to identify the tweets which are hate tweets and which are not.
6. Write a program in Python to predict the age of the actors.
7. Introduction to Python Libraries-Numpy, Pandas, Matplotlib, Scikit
8. Perform Data exploration and preprocessing in Python
9. Implement regularized Linear regression
10. Mini project to predict the time taken to solve a problem given the current status of the user.

TOTAL: 45 PERIODS

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

Standalone desktops with Python 3 interpreter for Windows/Linux 30 Nos. (or) Server with Python 3 interpreter for Windows/Linux supporting 30 terminals or more, Anaconda Navigator

HARDWARE:

Standalone Desktops: 30 Nos.

OUTCOMES:

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

- Import data sets for various analytical purposes.
- Develop interactive business applications that allow for data querying and data exploration.
- Collect, explore, clean and manipulate data.
- Develop Data science applications using Python based toolkits.
- Build Data science based mini project

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	1	-	-	-	-	1	-	-	2	1	2	-	-
CO 2	3	3	3	1	-	-	-	-	1	-	-	1	1	2	-	-
CO 3	3	3	3	1	-	-	-	-	1	-	-	1	1	1	-	1
CO 4	3	3	3	2	-	-	-	-	1	-	-	2	2	1	-	-
CO 5	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-
Average	3	3	3	1.2	-	-	-	-	1	-	-	1.5	1.2	1.4	-	1

DS3165 **MACHINE LEARNING LABORATORY** **L T P C**

0 0 3 1.5

OBJECTIVES:

- To make use of Data sets in implementing the machine learning algorithms
- To implement the machine learning concepts and algorithms in any suitable language of choice.
- To understand the reinforcement concept
- To evaluate the classification and clustering algorithms
- Learn the usage of python in implementing machine Learning algorithms

LIST OF EXPERIMENTS:

1. Study and usage of python tool.
2. Implement a classifier.
3. Develop a predictive model.
4. Implement a decision tree algorithm.
5. Implement back propagation algorithm.
6. Implement similarity based clustering algorithm.
7. Implement clustering algorithm for any data set.
8. Apply reinforcement learning.
9. Implement and demonstrate the Candidate-Elimination algorithm
10. Implement k-Nearest Neighbour algorithm
11. Implement the non-parametric Locally Weighted Regression algorithm

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply various classification and clustering techniques for problems using tools like Python
- Implement solutions for various prediction problems using tool
- Design and development of game and traffic control system using reinforcement learning
- Implement the machine learning algorithms using python
- Design and develop solutions for the machine learning algorithms using various datasets

LIST OF SOFTWARE FOR A BATCH OF 20 STUDENTS:

SOFTWARE: Python 3 interpreter for Windows/Linux, Open Source tools

HARDWARE: Standalone desktops 20 Nos.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	1	-	-	-	-	1	-	-	2	1	2	-	-
CO 2	3	3	3	2	-	1	-	-	1	-	-	1	1	2	-	-
CO 3	3	3	3	1	-	-	-	-	1	-	-	1	1	1	-	1
CO 4	3	3	3	2	-	-	-	-	1	-	-	2	2	1	-	-
CO 5	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-
Average	3	3	3	1	-	1	-	-	1	-	-	2	1	1	-	1

MA3223	STATISTICAL LEARNING FOR DATA SCIENCE	L	T	P	C
		4	0	0	4

OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables and concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples this plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments this plays very important roles in randomized block design, Latin square design.
- To introduce the basic concepts of Time Series as a discrete stochastic process.

UNIT–I: PROBABILITY AND RANDOM VARIABLES **12**

Random variables **(**Discrete and continuous**)**- Moments- Moment generating function-Probability Distributions-Binomial-Poisson- Geometric -Uniform-Exponential-and Normal distribution.

UNIT-II: TWO DIMENSIONAL RANDOM VARIABLES **12**

Joint Probability distribution-Marginal and conditional distribution covariance-correlation and regression line -Central limit theorem.

UNIT-III: TESTING OF HYPOTHESIS **12**

Sampling distributions - Tests for single mean and difference of means (Large and small samples) – Tests for single variance and equality of variances.

UNIT-IV: PARAMETRIC TESTS **12**

Chi-square tests for independence of attributes and goodness of fit – Design of experiments one way and two way classification.

UNIT-V: TIME SERIES ANALYSIS **12**

Time series as a discrete stochastic process. Stationarity- Main characteristics of stochastic process (mean, auto co variation and auto correlation function)-Autoregressive models AR (p) - Yull-Worker equation Auto regressive moving average models ARMA.

TOTAL: 60 PERIODS

OUTCOMES:

- Students will be able to understand the fundamental knowledge of the concepts of random variables and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Have the notion of sampling distributions classifications of design of experiments in the field of statistical quality control.
- Apply the basic concepts of Time Series as a discrete stochastic process

REFERENCES:

1. T.Veerarajan , “Probability, Statistics and Random Processes” Tata McGraw- Hill, Education 2008.
2. Maurice George Kendall, J. K. Ord,”Time series” Oxford University Press, 1990
3. K.S.Trivedi.John , “Probability and statistics with reliability, Queuing and computer Science Application”, Second edition, Wiley&Son, 2016.
4. Levin Richard and Rubin Davids, “Statistics for Management “, Pearson Publications,2016.
5. Robert Stine, Dean Foster ,“Statistical for Business: Decision Making and Analysis”. Pearson Education, 2nd edition,2013.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

DS3261 DATA PREPROCESSING AND OPTIMIZATION TECHNIQUES L T P C

3 0 0 3

OBJECTIVES:

- To understand the concept of data pre-processing
- To analyse the concept of data transformation
- To explore the data deduction and feature selection.
- To learn the concept of optimization techniques.
- To demonstrate the constrained and unconstrained optimization.

UNIT – I: INTRODUCTION TO DATA PREPARATION 9

Data Sets and Proper Statistical Analysis of Data Mining Techniques-Data Preparation Basic Models-Data Integration-Data Cleaning-Data Normalization.

UNIT - II: DATA PRE-PROCESSING & TRANSFORMATION 9

Dealing with Missing Values-Dealing with Noisy Data-Linear Transformations-Quadratic Transformations-Non-polynomial Approximations of Transformations-Polynomial Approximations of Transformations-Nominal to Binary Transformation.

UNIT - III: DATA REDUCTION &FEATURE SELECTION 9

Principal Components Analysis-Data Sampling-Data condensation, data squashing, data clustering, Feature Selection-Exhaustive Methods-Heuristic Methods-Nondeterministic Methods-Instance Selection: Prototype Selection Taxonomy-Edition Algorithms -Hybrid Algorithms.

UNIT - IV: UNCONSTRAINED OPTIMIZATION 9

Introduction-Conditions for Local Minimizes-Golden Section Search-Newton's Method-Secant Method- Gradient Methods- Steepest Descent-Conjugate Direction Methods-Unconstrained Optimization and Neural Networks.

UNIT - V: CONSTRAINED OPTIMIZATION 9

Simplex Method - Nonsimplex Methods - Problems with Equality Constraints : Tangent and Normal Spaces-Lagrange Condition-Convex Optimization Problems-Projections-Projected Gradient Methods with Linear Constraints.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyse the concept of data pre-processing
- Understand and analyses the concept of data transformation
- Explore the data deduction and feature selection.
- Apply the concept of unconstrained optimization techniques.
- Demonstrate the constrained in data analytics.

TEXT BOOKS:

1. Luengo, Julián, García, Salvador “Data Pre-processing in Data Mining”, (Intelligent Systems Reference Library Book 72) — Springer.
2. E. K. P. Chong and S. H. Zak, ‖ An Introduction to Optimization‖, 2nd Ed., Wiley India Pvt. Ltd., 2010.

REFERENCE BOOKS:

1. Robert M. Gower & Alexandre Gramfort “Optimization for Data Science” Master 2 Data Science, Univ. Paris Saclay
2. Stephen J. Wright “Optimization Algorithms for Data Analysis” IAS/Park City Mathematics Series.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	2	2	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	2	2	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO 4	2	2	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 5	2	2	2	2	-	-	-	-	-	-	-	-	-	3	-	-
Average	2	2	2	2	2	-	-	-	-	-	-	-	-	3	-	-

OBJECTIVES:

- To understand how to accurately represent voluminous complex data set in web and from other data sources.
- To understand the methodologies used to visualize large data sets.
- To understand the various process involved in data visualization.
- To apply data visualization techniques.
- To understand the different security aspects involved in data visualization

UNIT – I: INTRODUCTION 9

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

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

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

UNIT - III: DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT - IV: INTERACTIVE DATA VISUALIZATION 9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence. Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

UNIT - V: SECURITY **9**

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems – Creating Security visualization system.

TOTAL:45 PERIODS

OUTCOMES:

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

- Understand the representation of complex and voluminous data.
- Design and use various methodologies present in data visualization.
- Understand the various process and tools used for data visualization.
- Use interactive data visualization to make inferences.
- Discuss the process involved and security issues present in data visualization

TEXT BOOKS:

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.

REFERENCE BOOKS:

1. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007.
2. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis ", NoStarch Press Inc, 2007.
3. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	3	3	2	-	-	2	-	-	-	-	-	-	-	-	2
CO 2	2	3	3	-	2		2	2	-	-	-	-	-	-	-	2
CO 3	2	3	3	-	-	-	2	-	-	-	1	-	-	-	-	2
CO 4	2	3	2	-	2	-	2	-	-	-	2	-	-	-	-	2
CO 5	2	3	2	-	-	-	2	-	-	-	-	-	-	-	-	2
Average	2	3	2.6	2	2	-	2	2	-	-	1.5	-	-	-	-	2

DS3263	BIG DATA MINING AND ANALYTICS	L T P C
		3 0 0 3

OBJECTIVES:

- To understand the computational approaches to Modeling, Feature Extraction
- To understand the need and application of Map Reduce
- To understand the various search algorithms applicable to Big Data
- To analyse and interpret streaming data
- To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data

UNIT – I: DATA MINING AND LARGE-SCALE FILES 9

Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce – Efficiency of Cluster Computing Techniques.

UNIT - II: SIMILAR ITEMS 9

Nearest Neighbor Search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents – Distance Measures – Theory of Locality Sensitive Functions – LSH Families – Methods for High Degree of Similarities.

UNIT - III: MINING DATA STREAMS 9

Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

UNIT - IV: LINK ANALYSIS AND FREQUENT ITEMSETS 9

Page Rank –Efficient Computation - Topic Sensitive Page Rank – Link Spam – Market Basket Model – A-priori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets.

UNIT- V: CLUSTERING 9

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE –Clustering in Non -– Euclidean Spaces – Streams and Parallelism – Case Study: Advertising on the Web – Recommendation Systems.

TOTAL:45 PERIODS

OUTCOMES:

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

- Design algorithms by employing Map Reduce technique for solving Big Data problems.
- Design algorithms for Big Data by deciding on the apt Features set.
- Design algorithms for handling petabytes of datasets
- Design algorithms and propose solutions for Big Data by optimizing main memory consumption
- Design solutions for problems in Big Data by suggesting appropriate clustering techniques.

TEXT BOOKS:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets",Cambridge University Press, 3rd Edition, 2020.
2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2012.

REFERENCE BOOKS

1. Ian H.Witten, Eibe Frank "Data Mining – Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
2. David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS, 2001

WEB REFERENCES:

1. https://swayam.gov.in/nd2_arp19_ap60/preview

2.https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106104189/lec1.pdf

ONLINE RESOURCES:

1. https://examupdates.in/big-data-analytics/
2. https://www.tutorialspoint.com/big_data_analytics/index.htm
3. https://www.tutorialspoint.com/data_mining/index.htm

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	1	-	-	-	-	-	-	-	-	3	-	-	-
CO 2	-	-	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO 3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 4	-	3	3	-	2	1	-	-	-	-	-	-	-	3	-	-
CO 5	-	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
Average	3	3	3	2	2	1	-	-	-	-	-	-	3	3	2	-

OBJECTIVES:

- To understand the basic building blocks and general principles that allow one to design machine learning algorithms
- To become familiar with specific, widely used machine learning algorithms
- To introduce building blocks of deep neural network architecture
- To understand representation and transfer of knowledge using deep learning
- To learn to use deep learning tools and framework for solving real-life problems

UNIT – I: INTRODUCTION 9

Basic Concepts, Introduction to Machine Learning, Applications of ML, Design Perspective and Issues in ML, Supervised, Unsupervised, Semi-supervised learning with applications and issues.

UNIT - II: DEEP NETWORKS 9

Deep Networks – Introduction to Neural Networks, Feed-forward Networks, Deep Feed-forward Networks - Learning XOR, Gradient Based learning, Hidden Units, Back-propagation and other Differential Algorithms, Regularization for Deep Learning, Optimization for training Deep Models.

UNIT - III: CONVOLUTIONAL NETWORKS 9

Convolution operation, Motivation, Pooling, Convolution and Pooling as strong prior, Efficient convolution algorithms, Unsupervised features, Sequence Modeling: Recurrent and Recursive Nets, LSTM Networks, Applications - Computer Vision, Speech Recognition, Natural Language Processing.

UNIT - IV: OPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization. Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM -Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning -Computational & Artificial Neuroscience

UNIT - V: DEEP LEARNING FRAMEWORKS 9

Introduction to Keras and Tensorflow, Deep Learning for computer vision - convnets, Deep Learning for Text and Sequences, Generative Deep Learning - Text Generation with LSTM, Deep Dream, Neural Style Transfer, Generating images with variational auto encoders, Generative Adversarial Networks (GAN).

TOTAL: 45 PERIODS

OUTCOMES:

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

- Ability to implement and apply machine learning algorithms to real-world applications.
- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains
- Incorporate transfer of knowledge in machine learning algorithms
- Implement deep learning algorithms and solve real-world problems
- Understand the deep learning tools and framework for solving real-life problems

TEXT BOOKS:

Ethem Alpaydin, ―Introduction to Machine Learning‖, PHI, 2005 2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ―Deep Learning‖, The MIT Press, 2016.

REFERENCE BOOKS:

1. Tom Mitchell, ―Machine Learning‖, McGraw-Hill, 1997
2. Francois Chollet, ―Deep Learning with Python, Manning Publications, 2017
3. Aurélien Géron, ―Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media; 1 edition (April 9, 2017)
4. Josh Patterson, ―Deep Learning: A Practitioner's Approach‖, O'Reilly Media; 1 edition (August 19, 2017)

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	-
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CO 4	2	2	2	2	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	2	2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
Average	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2	-

DS3265 **DATA VISUALIZATION LABORATORY** **L T P C**

0 0 4 2

OBJECTIVES:

- To understand the need of different datasets visualization
- Can perform descriptive and inferential analysis on data sets
- Can create visualization using modern tool
- Can develop analytical products
- Identify opportunities for application of data visualization in various domains

LIST OF EXPERIMENTS:

1. Identification of different types of data on the dataset
2. Visualization of datasets in terms of Line Chat, Area Chart, Bar Chart, Pie Chart, histogram, scatterplot, violin plot etc.
3. Representation of datasets and performing various statistical operation
4. Interactive Development of dashboard
5. Creating Visualization with Tableau
6. Presenting the working of dataset with Pivot Tables and Pivot Chart
7. Making World Map interaction with D3.js and SVG
8. Analysis of Variance (ANOVA)
9. Analysis of Covariance(ANCOVA)
10. Statistics associated with cluster Analysis
11. Design and development of Analytical products

TOTAL: 60 PERIODS

OUTCOMES:

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

- Design and create data visualizations.
- Conduct exploratory data analysis using visualization.
- Craft visual presentations of data for effective communication.
- Use knowledge of perception and cognition to evaluate visualization design alternatives.
- Use JavaScript with D3.js to develop interactive visualizations for the Web.

LIST OF SOFTWARE FOR A BATCH OF 20 STUDENTS:

SOFTWARE:

1. Tableau/Apache Spark
2. Python Version 3.X
3. JavaScript enabled browser

HARDWARE:

Standalone desktops 20 Nos.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	3	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO 2	2	3	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO 3	2	3	3	-	2	-	-	-	-	3	-	-	-	-	3	-
CO 4	-	3	3	-	2	-	2	-	-	3	3	2	-	-	3	2
CO 5	-	3	3	-	2	-	2	-	-	2	3	2	-	-	3	2
Average	2	3	3	-	2	-	2	-	-	3	3	2	-	-	3	2

ELECTIVES

PDS101 DEVOPS AND MICRO-SERVICES L T P C

3 0 0 3

OBJECTIVES:

- Explain an overview of Micro services and Containers.
- Understand the key concepts and principles of DevOps
- List the most common DevOps tools
- Identify the business benefits of DevOps and continuous delivery.
- Recall the specific DevOps methodologies and frameworks.

UNIT – I: INTRODUCTION TO MICROSERVICES 9

Definition of Micro services – Characteristics – Micro services and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

UNIT - II: MICROSERVICES ARCHITECTURE 9

Monolithic architecture- Micro service architectural style- Benefits - Drawbacks of Micro service architectural style - decomposing monolithic applications into Micro services.

UNIT - III: BASICS OF DEVOPS 9

History of DevOps- DevOps and software development life cycle- water fall model – agile model – DevOps life cycle – DevOps tools: distributed version control tool –Git- automation testing tools – Selenium - reports generation – TestNG - User Acceptance Testing – Jenkins.

UNIT - IV: MICROSERVICES IN DEVOPS ENVIRONMENT 9

Evolution of Microservices and DevOps – Benefits of combining DevOps and Microservices working of DevOps and Microservices in Cloud environment - DevOps Pipeline representation for a NodeJS based Microservices.

UNIT - V: VELOCITY AND CONTINUOUS DELIVERY 9

Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and Devops- Infrastructure and the job of Ops.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the Microservices and containers.
- Explain the architecture of Microservices.
- Describe DevOps and the common tools used in DevOps.
- Apply Microservices in DevOps.
- Develop, integrate and deploy projects using DevOps.

TEXT BOOKS:

1. Namit Tanasseri, RahulRai, “Microservices with Azure”, 1st Edition, Packt Publishing, UK, 2017.
2. Eberhard Wolff, “Microservices: Flexible Software Architecture”, 1st Edition, Pearson Education, 2017

REFERENCE BOOKS:

1. James A Scott, “A Practical Guide to Microservices and Containers”, Map R Data Technologies, e–book: https://mapr.com/ebook/microservicesandcontainers/assets/microservices-and-containers.pdf.
2. Joyner Joseph, Devops for Beginners, First Edition, Mihails Konoplovs publisher, 2015.
3. Gene Kim, Kevin Behr, George Spafford, The Phoenix Project, A Novel about IT, DevOps, 5th Edition, IT Revolution Press, 2018.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO 3	3	3	2	-	2	-	-	-	-	-	-	-	3	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-	-
Average	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-	-

PDS102 MOBILE APPLICATION DEVELOPMENT L T P C

OBJECTIVES:

- To understand the need and characteristics of mobile applications.
- Be familiar with the network protocol stack.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile application using various tools and platforms.

UNIT – I: INTRODUCTION 9

Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools.

UNIT - II: MOBILE TRANSPORT AND APPLICATION LAYER 9

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

UNIT - III: USER INTERFACE 9

Generic UI Development – Designing the Right UI – Multimodal and Multichannel UI – Gesture Based UI – Screen Elements and Layouts – Voice XML.

UNIT - IV: APPLICATION DESIGN 9

Memory Management – Design Patterns for Limited Memory – Work Flow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Concurrency and Resource Management.

UNIT - V: APPLICATION DEVELOPMENT 9

Mobile OS: Android, iOS – Android Application Architecture – Android basic components – Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the concepts of functionality of Transport and Application layer.
- Design the right user interface for mobile application.
- Implement mobile application using UI toolkits and frameworks.
- Design a mobile application that is aware of the resource constraints of mobile devices.
- Develop web based mobile application that accesses internet and location data.

TEXT BOOKS:

1. Reto Meier, “Professional Android 4 Application Development”, Wiley, 2012 . (Unit-I)
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, O’Reilly, 2012.(Unit – III & IV)
3. Alasdair Allan, “iPhone Programming”, O’Reilly, 2010. (Unit-V)
4. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003. (Unit-II)

REFERENCE BOOKS:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	1	2	2	3	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	1	2	2	3	-	-	-	-	-	-	-	-	-	-
CO 3	2	2	2	3	2	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	2	2	2	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	3	2	2	3	-	-	-	-	-	-	-	-	-	-
Average	2.4	2.4	1.8	2.2	2	3	-	-	-	-	-	-	-	-	-	-

OBJECTIVES:

- To get an overview of the web development software.
- To understand the object-oriented structure and user interface programming through Python.
- To gain knowledge of web development using Flask Framework.
- To learn the web application deployment in real time scenarios.
- To learn to deploy the software in Linux and Windows platforms.

UNIT – I: OBJECT ORIENTED APPROACH IN PYTHON 9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

UNIT - II: USER INTERFACE APPLICATIONS IN PYTHON AND VERSION CONTROL SYSTEM 9

Wxpython Installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands.

UNIT - III: FLASK FRAMEWORK FOR WEB DEVELOPMENT 9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine.

UNIT - IV: REAL TIME DEPLOYMENT OF WEB APPLICATION 9

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

UNIT - V: DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM 9

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment in Windows – Creation of Standalone Executable – Test Cases.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the object-oriented approach in Python.
- Develop GUI applications with Python.
- Use the collaborative version control system, git.
- Package the developed code in Linux and Windows environment.
- Deploy the developed web application using Flask in real time scenarios suchas AWS.
- Developer of the industrial software.

TEXT BOOKS:

1. Mark Lutz, “Learning Python”, Fifth Edition, O’ Reilly 2013. (Unit – I & II)
2. Miguel Grinberg, “Flask Web Development Developing Web Applications with Python”, OReilly, 2014. (Unit – III & IV)
3. Karl Seguin, “The Little Mongo DB Book”, https://github.com/karlseguin/the-little-mongodb-book.

REFERENCE BOOKS:

1. Mark Lutz, “Learning Python”, Fifth Edition, O’ Reilly 2013.
2. http://zetcode.com/wxpython/
3. Gareth Dwyer, “Flask by Example”, Packt Publishers, 2016.
4. https://aws.amazon.com/education/awseducate/
5. http://packaging.ubuntu.com/html/packaging-new-software.html
6. http://www.pyinstaller.org/
7. https://pypi.org/project/py2exe/0.9.2.0/

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	1	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	1	1	3	3	3	1	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
Average	2	1.2	3	3	3	2	-	-	-	-	-	-	-	-	-	-

PDS104 **WEB DESIGN AND MANAGEMENT** **L T P C**

3 0 0 3

OBJECTIVES:

- Understand the design principles and interaction.
- To explore the detailed design practices, standards.
- To gain an insight into Content Management System for content design.
- To use any Content Management System tool for better content management.
- To get familiarized with Web Analytics for better management.

UNIT – I: PRINCIPLES OF WEB DESIGN **9**

User Centered Design, Web Medium, Information Architectures, Site Types and Architectures, Page Structure, Site Maps, Navigation, Search, Web Design Process, Designing for Multiple Screen Resolutions, Creating A Unified Site Design, Evaluating Web Sites.

UNIT - II: ELEMENTS OF PAGE DESIGN **9**

Elements Of Page Design, Adding Styles With CSS, Pages And Layout, Typography, Color, Images, GUI Widgets and Forms, Responsive Web Designs, User Input Forms, Working With Data Tables, Web Standards And Styles.

UNIT - III: WEB CONTENT DESIGN **9**

Features – Automated Templates – Template Processor –Front Controller Pattern – Content Modeling – Content Aggregation – Plug-Ins – Search Engine Optimization – Recommended Usage Of Tools – WORDPRESS

UNIT - IV: WEB CONTENT MANAGEMENT **9**

Work Flow Management – Document Management – Collaboration – Versioning – Recommended Usage Of Tools – WORDPRESS

UNIT - V: WEB ANALYTICS **9**

Web Analytics Process – Data Collection – Qualitative Analysis – Log File Analysis – Page Tagging – Hybrid Methods – Click Analytics – Onsite And Offsite Analytics – Web Analytics Methods

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design web pages that follow standards and are usable.
- Design web sites that are appealing.
- To be able to use Content management System for designing web Content.

- To take advantage of Content Management System tools for managing content for large web sites.
- To be able to use analytics tools for better management.

TEXT BOOKS:

1. Patrich J. Lynch, Sarah Horton, “Web Style Guide-Foundations of User Experience Design”, Yale University Press, 4th Edition, 2016.
2. Thomas A. Powell, “The Complete Reference– Web Design”, Tata McGraw Hill, Second Edition, 2003.
3. Joel Sklar, “Principles of Web Design, Cengage Learning”, Web Warrior Series, 6th Edition,2015.

REFERENCE BOOKS:

1. Deane Barker, “Web Content management-Systems, Features and Best Practices”, O’reilly Media, 1st Edition, 2016.
2. Brian Clifton, “Advanced web Metrics with Google Analytics”, Third Edition, Sybex Publishers, 2012.
3. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity”, 1st edition, Sybex publishers, 2009.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	1	2	3	2		-	-	-	-	-	-	2	2		-
CO 2	2	1	2	3	2	1	-	-	-	-	-	-	2	2		-
CO 3	2		3	3	3	1	-	-	-	-	-	-	2	2		-
CO 4	1		3	3	3	3	-	-	-	-	-	-	2	2	3	-
CO 5	3		3	3	3	3	-	-	-	-	-	-	2	2		-
Average	2	1	2.6	3	2.6	2							2	2	3	

PDS105	WEB ANALYTICS	L T P C
		3 0 0 3

OBJECTIVES:

- To get familiarize with basics of web analytics
- To understand about data collection and web analytics fundamentals
- To explore web metrics and analytics
- To understand the concepts of qualitative analysis
- To understand web analytics 2.0

UNIT – I: INTRODUCTION TO WEB ANALYTICS 9

Definition, Process, Key Terms: Site References, Keywords and Key Phrases; Building Block Terms: Visit Characterization Terms, Content Characterization Terms, Conversion Metrics; Categories: Offsite Web, on Site Web; Web Analytics Platform, Web Analytics Evolution, Need of Web Analytics, Advantages & Limitations.

UNIT - II: DATA COLLECTION AND WEB ANALYTICS FUNDAMENTALS 9

Capturing Data: Web Logs, Web Beacons, Java Script Tags, Packet Sniffing; Outcome Data: E-commerce, Lead Generation, Brand/ Advocacy and Support; Competitive Data: Panel Based Measurement, ISP Based Measurement, Search Engine Data; Organisational Structure.

Type and Size of Data, Identifying Unique Page Definition, Cookies, Link Coding Issues.data quality, identifying unique page definition, Using cookies, Link coding issues.

UNIT - III: WEB METRICS AND ANALYTICS 9

Web Metrics & Analytics: Common Metrics: Hits, Page Views, Visits, Unique Page Views, Bounce, Bounce Rate & its Improvement, Average Time on Site, Real Time Report, Traffic Source Report, Custom Campaigns, Content Report, Google Analytics; Key Performance Indicator: Need, Characteristics, Perspective and Uses.

Graphs and Matrices- Basic Measures for Individuals and Networks. Random Graphs & Network Evolution, Social Context: Affiliation & Identity

Web analytics Tools: A/B testing, Online Surveys, Web Crawling and Indexing. Natural Language Processing Techniques for Micro-Text Analysis

UNIT - IV: QUALITATIVE ANALYSIS 9

Heuristic Evaluations: Conducting a Heuristic Evaluation, Benefits of Heuristic Evaluations; Site Visits: Conducting a Site Visit, Benefits of Site Visits; Surveys: Website Surveys, Post-Visit Surveys, Creating and Running a Survey, Benefits of Surveys.

UNIT - V: WEB ANALYTICS 2.0 9

Web Analytics 2.0: Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis: CI data sources, Toolbar data, Panel data, ISP data,

Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze the characteristics of website
- Capture and identify the features of web data
- Apply web metrics and analytics for the websites
- Perform qualitative analysis of the websites
- Understand web analytics 2.0 and google analytics

TEXT BOOKS:

1. Avinash Kaushik, “Web Analytics: An Hour a Day”, O’Reilly, 2007
2. Michael Beasley, “Practical Web Analytics for User Experience”, O’Reilly, 2013

REFERENCE BOOKS:

1. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, Sybex, 2009
2. Jim Sterne, Web Metrics: Proven Methods for Measuring Web Site Success, John Wiley & Sons, 2003
3. Brian Clifton, Advanced Web Metrics with Google Analytics, Wiley, 2012

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO 3	3	3	-	-	2	-	-	-	-	-	-	-	3	2	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	-	-	2	-	-	-	-	-	-	-	3	2	-	-

PDS201 **ETHICS AND AI** **L T P C**

3 0 0 3

OBJECTIVES:

- Discuss the ethical challenges of AI and Data Science.
- Analyse moral responsibility versus liability in the context of AI and understand the consequences of liability.
- Identify general business risks associated with AI and explore the ethical risks involved.
- Identify general business risks associated with AI and explore the ethical risks involved.
- Discuss practical strategy and challenges of building an AI framework.

UNIT – I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND ETHICS 9

Introduction to AI- Types of AI Systems- Machine learning- Science and Fiction of AI- Ethics :Descriptive Ethics- Normative Ethics- Meta ethics- Applied Ethics- Relationship Between Ethics and Law- Codes of Ethics in Context-Machine Ethics- Moral Diversity and Testing- Normative Ethical Theories- Ethics and Empirical Evidence- AI, Codes of Ethics and the Law

UNIT - II: TRUST AND FAIRNESS IN AI SYSTEMS 9

User Acceptance and Trust- Functional Elements of Trust- Ethical Principles for Trustworthy and Fair AI- Non-maleficence Responsibility and Liability: Moral Responsibility Versus Liability- Complex Liability- Strict Liability- Consequences of Liability.

UNIT - III: RISKS AND PSYCHOLOGICAL ASPECTS OF AI 9

General Business Risks- Ethical Risks of AI- Managing Risk of AI- Business Ethics for AI Companies- Risks of AI to Workers- Persuasive AI- Misplaced Feelings Towards AI-Misplaced Trust in AI-Unidirectional Emotional Bonding with AI.

UNIT - IV: PRIVACY ISSUES AND APPLICATION AREAS OF AI 9

Introduction- Why AI Needs Data- Private Data Collection and its Dangers- Future Perspectives- Ethical Issues Related to AI Enhancement- Restoration Versus Enhancement- Application areas of AI :Robots and Telemedicine- Education- Quality of Care- Exoskeletons- Psychological Care- Nudging**.**

UNIT - V: AUTONOMOUS VEHICLES AND MILITARY USES OF AI 9

Levels of Autonomous Driving- Current Situation- Ethical Benefits of AV- Accidents with AVs- Ethical Guidelines for AVs- Privacy and security Issues- Military Uses of AI: Definitions, The Use of Autonomous Weapons Systems- Regulations Governing an AWS- Ethical Arguments for and Against AI for Military Purposes- Ethics in AI and Robotics: A Strategic Challenge.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the ethical challenges of AI and Data Science.
- Understand moral responsibility versus liability in the context of AI.
- Understand the ethical implications for AI companies and the potential impact of AI on workers.
- Examine privacy issues related to AI, including the risks associated with private data collection.
- Understand the practical strategy and challenges of building an AI framework.

TEXT BOOKS:

Liao, S. Matthew (ed.) “Ethics of Artificial Intelligence” Oxford University Press., 2020.

REFERENCE BOOKS:

1. Alberto Chierci” The Ethics of AI: Facts, Fictions and Forecasts”, 2021.
2. Mark Coeckelbergh “AI Ethics”, The MIT Press,2020.
3. Markus D. Dubber (ed.), Frank Pasquale (ed.), Sunit Das (ed.) “The Oxford Handbook of Ethics of AI”, Oxford University Press, 2020.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	2	-	-	-	2	-	-	-	-	2	3	2	-
CO 2	3	3	3	2	-	-	-	2	-	-	-	-	2	2	2	-
CO 3	3	3	3	2	-	-	-	-	-	-	-	-	2	2	3	-
CO 4	3	3	3	2	-	-	-	-	-	-	-	-	2	2	3	-
CO 5	3	3	3	3	-	-	-	-	-	-	-	-	2	2	3	-
Average	3	3	3	2.2	-	-	-	2	-	-	-	-	2	2.2	2.6	-

PDS202 MODERN CRYPTOGRAPHY AND CRYPTOCURRENCY L T P C

3 0 0 3

OBJECTIVES:

- Understand basic encryption methods and algorithms, the strengths and weaknesses of encryption algorithms
- Understand how to deploy encryption techniques to secure data stored on computer systems
- Understand how to deploy encryption techniques to secure data in transit across data network
- Discuss the basic concepts of Crypto currency and bitcoin.
- Explore the knowledge about bitcoin mining.

UNIT – I: FUNDAMENTALS OF CIPHER TECHNIQUES 9

Foundations–Terminology, Steganography, Substitution Ciphers and Transposition Ciphers, One Way Functions, one way hash functions, Communications using public key cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo random sequence generation key exchange, Authentication and key exchange, Key Management, Key Length, Information Theory.

UNIT - II: SECRET KEY CRYPTOGRAPHY 9

Introduction-Encryption- Shannon ciphers and perfect security- Computational ciphers and semantic security- Stream ciphers- linear generators- RC4 stream cipher- computational in distinguishability- coin flipping and commitments- Block ciphers- AES algorithm- DES algorithm- Sophisticated attacks on block ciphers- Pseudo-random functions: basic definitions and properties- The ideal cipher model.

UNIT - III: PUBLIC KEY CRYPTOGRAPHY 9

Public key encryption- RSA Algorithm- Diffe-Hellman key exchange- Discrete logarithm- Collision resistant hash functions- ElGamal encryption- Threshold decryption- Chosen ciphertext secure public key encryption: Basic definitions- Case study: PKCS1, OAEP, OAEP+, and SAEP.

UNIT - IV: INTRODUCTION TO CRYPTOCURRENCY AND BITCOIN 9

Introduction to Cryptocurrency-The Digital Signature-A Tamper Proof Ledger-Blockchain-Distributed Consensus-Proof of Work-Cryptocurrency as an Asset Class-Risk and Return to Cryptocurrency-Review of Portfolio Theory-Asset Allocation with Cryptocurrency-The Blockchain Ecosystem:Building the Blockchain-Crypto Finance.

UNIT - V: BITCOIN AND ALTCOIN 9

Introduction-Bitcoin's protocols-Bitcoin applications & security-Bitcoin mining mechanics-Bitcoin mining strategy & attacks-Bitcoin community, economics & politics-Extensions and altcoins:Alternative approaches to mining & consensus-Privacy-enhanching & zero-knowledge cryptocurrencies-Overview of altcoins-Ethereum:Programming smart contracts on Ethereum-Case study: Ethereum & the DAO.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basics of information theory and its relevance to cryptography.
- Acquire the knowledge on the fundamentals of various encryption techniques and algorithms
- Apply the principles of various encryption techniques to secure data in transit across data networks
- Understand the concepts of Crypto currency and bitcoin.
- Apply the bitcoin mining Techniques and attacks

TEXT BOOKS:

1. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2004
2. Josh Thompsons, “Blockchain: The Blockchain for Beginners- Guide to Blockchain Technology and Leveraging Blockchain Programming”, 2017

REFERENCE BOOKS:

1. AtulKahate, “Cryptography and Network Security”, Tata McGrew Hill, 2003.
2. BlockchainTechnology: Cryptocurrency and Applications by S.Shukla, M.Dhawan, S.Sharma, Venkatesan, Oxford University Press2019.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	-	2	-
CO 2	2	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-
CO 3	2	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-
CO 4	2	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-
CO 5	2	3	3	3	2	-	-	-	-	-	-	-	2	-	2	-
Average	2.2	3	3	3	2	-	-	-	-	-	-	-	2.2	-	2	-

PDS203 **SOCIAL NETWORK SECURITY** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the component of the social network.
- To gain knowledge from disciplines as diverse as sociology
- To learn various risks in social media.
- Identify the various ways to manage the risk in Social networks
- Understand Social Network Privacy Policies And Security

UNIT – I INTRODUCTION 9

Overview: Social network- Paths and Connectivity- Distance and Breadth-First Search- Network Datasets - Strong and Weak Ties - Triadic Closure - The Strength of Weak Ties - Tie Strength and Network Structure in Large-Scale Data - Tie Strength, Social Media, and Passive Engagement - Closure, Structural Holes, and Social Capital.

UNIT – II SOCIAL INFLUENCE 9

Homophily: Mechanisms Underlying Homophily, Selection and Social Influence, Affiliation, Tracking Link Formation in On Line Data, Spatial Model of Segregation - Positive and Negative Relationships - Structural Balance - Applications of Structural Balance, Weaker Form of Structural Balance.

UNIT - III RISKS OF SOCIAL MEDIA 9

Risks of social media-public embarrassment-false information-information leakage-retention and archiving content-backing up social media-loss of data. The dark side of social media-cybercrime-social engineering-hacked accounts.

UNIT - IV RISK MANAGEMENT 9

Risk management -Assessing risks -Laws and regulations -Insurance -Forensics -Police use of social media - Malware, viruses, and exploit distribution-Scareware/ransomware-Baiting-Browser hijacking

UNIT - V PRIVACY POLICIES AND SECURITY 9

Policy and privacy: Policies- Policies affected by social network-Antidiscrimination and Anti-harassment privacy -blocking users-controlling app privacy-location awareness-Security: security-fake accounts-passwords-privacy and information sharing-content security

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop semantic web related simple applications
- Address Privacy and Security issues in Social Networking
- Explain the data extraction and mining of social networks
- Discuss the prediction of human behavior in social communities
- Describe the applications of social networks

TEXT BOOKS:

1. Easley and Kleinberg, “Networks, Crowds, and Markets: Reasoning about a highly connected world”, Cambridge Univ. Press, 2010.
2. Michael Cross, ”Social Media Security: Leveraging Social Networking While Mitigating Risk” Elsevier

REFERENCE BOOKS:

1. Wasserman, S., & Faust, K, —Social Network Analysis: Methods and Applications, Cambridge University Press; 1 edition, 1994
2. Borgatti, S. P., Everett, M. G., & Johnson, J. C., —Analyzing social networks, SAGE Publications Ltd; 1 edition, 2013.
3. Robert A. Hanneman and Mark Riddle, “Introduction to social network methods”, University of California, 2005

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
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CO 1	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 4	3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 5	3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
Average	3	3	2.2	3	-	-	-	-	-	-	-	-	-	2.2	-	-

PDS204 **BLOCKCHAIN TECHNOLOGIES** **L T P C**

3 0 0 3

OBJECTIVES:

- Understand emerging abstract models for Blockchain Technology.
- To acquire the basic knowledge and understandings of Bitcoin
- It provides conceptual understanding of the function of Blockchain
- To understand the mechanisms of Bitcoin, Ethereum, Hyperledger.
- To develop familiarity of current technologies, tools, and implementation strategies.

UNIT – I: INTRODUCTION TO BLOCKCHAIN AND CRYPTO CURRENCY 9

Cryptography and Cryptocurrency- Digital Signatures-Crypto currency Hash Codes- Bitcoin-Bitcoin ecosystem A basic crypto currency, Creation of coins,-Block chain- An Introduction Distinction between databases and Block chain- Distributed ledger-Block chain ecosystem Block chain structure- Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT - II: BITCOIN AND BLOCKCHAIN 9

Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions-Parameters that invalidate the transactions- Scripting language in Bitcoin Applications of Bitcoin script- Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT- III: BITCOIN CONSENSUS 9

Consensus introduction, -Consensus in a Bitcoin network Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos

UNIT- V: DISTRIBUTED CONSENSUS 9

Distributed consensus in open environments -RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease-BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine -Fault Tolerance.

UNIT - V: HYPER LEDGER FABRIC & ETHERUM 9

Hyperledger Architecture, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining,

DApps, DAO. Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand block chain technology.
- Develop block chain based solutions and write smart contract using Hyper ledger Fabric and Ethereum frameworks.
- Identify and analyze the applications of Bitcoin script
- Integrate ideas from various domains and implement them using block chain technology in different perspectives.
- Develop private Block chain environment and develop a smart contract on Ethereum

TEXT BOOKS:

1. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Josh Thompsons, “Blockchain: The Blockchain for Beginners- Guide to Blockchain Technology and Leveraging Blockchain Programming”, 2017

REFERENCE BOOKS:

1. Bashir, Imran “”Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks”,2017.
2. Blockchain Technology: Cryptocurrency and Applications by S.Shukla, M.Dhawan, S.Sharma, Venkatesan, Oxford University Press 2019.
3. Joseph Bonneau et al, “SoK: Research perspectives and challenges for Bitcoin and crypto currency”, IEEE Symposium on security and Privacy, 2015.
4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos2018
5. Dreas Antonopoulos, Mastering Ethereum: Building Smart Contracts and Dapps, O’Reilly 2018.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	-	-	-	-	-	-	-	-	2	2	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2	2
CO 5	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2	2
Average	3	3	3	3	-	-	-	-	-	-	-	-	2	2	1.6	2

PCP3221 INFORMATION RETRIEVAL TECHNIQUES L T P C

3 0 0 3

OBJECTIVES:

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

UNIT – I INTRODUCTION 9

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

UNIT – II RETRIEVAL MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting

– Scoring and Ranking –Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT - III INDEXING 9

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

UNIT - IV EVALUATION AND PARALLEL INFORMATION RETRIEVAL 9

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

UNIT - V SEARCHING THE WEB 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

REFERENCE BOOKS:

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, Prabhakar Raghavan, Hinrich Schutze, “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.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	-	-	-	-	3		1	-	-	-	2	-	2	-	2	-
CO 2	-	-	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-
CO 4	3	1	-	-	-	2	-	-	-	3		-	-	-	-	-
CO 5	-	-	3	-	-	-	-	2	2	-	-	-	-	-	-	2
Average	3	1	3	2	3	2	1	2	2	3	2	2	2	2	2	2

PDS301 **AUGMENTED REALITY/VIRTUAL REALITY** **L T P C**

3 0 0 3

OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT – I INTRODUCTION **9**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT - II VR MODELING **9**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management

UNIT - III VR PROGRAMMING **9**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT - IV APPLICATIONS **9**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT - V AUGMENTED REALITY 9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation Navigation-Wearable devices

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basic concepts of AR and VR
- Understand the tools and technologies related to AR/VR
- Know the working principle of AR/VR related Sensor devices
- Design of various models using modeling techniques
- Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
CO 2	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 3	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 4	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
Average	3	3	3	3	2	-	-	-	-	-	-	-	2.2	2.2		2

PDS302 **3D PRINTING TECHNOLOGIES** **L T P C**

3 0 0 3

OBJECTIVES:

- The course is designed to impart knowledge and skills related to 3D printing technologies.
- Selection of material and equipment and develop a product using this technique.
- To understand Industry 4.0 environment.
- To understand CAD and Additive manufacturing
- To understand Additive Equipment.

UNIT – I: 3D PRINTING AND ADDITIVE MANUFACTURING 9

Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.

UNIT - II: CAD AND ADDITIVE MANUFACTURING 9

CAD for Additive Manufacturing-CAD Data formats, Data translation, Data loss, STL format. Additive Manufacturing Techniques - Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology.

UNIT - III: PROCESS 9

Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

UNIT - IV: MATERIALS 9

Polymers, Metals, Non-Metals, Ceramics, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Support Materials.

UNIT - V: ADDITIVE MANUFACTURING EQUIPMENT 9

Process Equipment- Design and process parameters-Governing Bonding Mechanism-Common faults and troubleshooting - Process Design- Post Processing: Requirement and Techniques- Product Quality.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop CAD models for 3D printing.
- Import and Export CAD data and generate .stl file.
- Select a specific material for the given application.
- Select a 3D printing process for an application.
- Produce a product using 3D Printing or Additive Manufacturing (AM).

TEXTBOOKS

1. Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.2020
2. CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.

REFERENCE BOOKS:

1. Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
3. J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
4. L. Lu, J. Fuh and Y.S. Wong, “Laser-Induced Materials and Processes for Rapid Prototyping”, Kulwer Academic Press, 2001.
5. Zhiqiang Fan And Frank Liou, “Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy”, InTech, 2012.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
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CO 3	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 4	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
Average	3	3	3	3	2	-	-	-	-	-	-	-	2.2	2.2	-	2

PDS303 **ROBOTIC PROCESS AUTOMATION** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
- To study about the electrical drive systems and sensors used in robotics for various applications
- To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
- To learn about various motion planning techniques and the associated control architecture
- To understand the implications of AI and other trending concepts of robotics

UNIT – I: FOUNDATION FOR BEGINNERS **9**

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications - Role and need of robots for the immediate problems of the society, future of mankind and automation - Ethical issues - Industrial scenario local and global - case studies on mobile robot research platform and industrial serial arm manipulator.

UNIT - II: BUILDING BLOCKS OF A ROBOT **9**

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators - Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors - Case study on choice of sensors and actuators for maze solving robot and self driving cars.

UNIT - III: KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS **9**

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics - Mechanical design aspects of a 2R manipulator, WMR - End-effector - Common types and design case study.

UNIT - IV: NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE **9**

Mapping & Navigation – SLAM, Path planning for serial manipulators - Types of control architectures - Cartesian control, Force control and hybrid position/force control - Behaviour

based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot.

UNIT - V: AI AND OTHER RESEARCH TRENDS IN ROBOTICS 9

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nano robots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
- Examine different sensors and actuators for applications like maze solving and self driving cars
- Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots
- Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning
- Describe the impact and progress in AI and other research trends in the field of robotics

TEXT BOOKS:

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

REFERENCE BOOKS:

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.
4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.
5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000.
6. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005.

7. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and Technology of Self–Organizing Machines (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004.

CO - PO and CO - PSO MAPPING

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CO 4	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO 5	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
Average	3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2

OBJECTIVES:

- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution.
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To explore the EDGE AND FOG computing architectures.
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT I VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE 9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization Implementation levels of virtualization – virtualization Structure –virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management, Virtualizationfor data center automation.

UNIT II CLOUD PLATFORM ARCHITECTURE 9

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software – Layered cloud Architectural Development - Architectural Design Challenges

UNIT-III EDGE AND FOG COMPUTING 9

Fog Computing, Characteristics, Application Scenarios, Issues and challenges-Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities,healthcare and vehicles.

Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing

UNIT IV CLOUD PLATFORMS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes-.WindowsAzure: Origin of Windows Azure, Features, The Fabric Controller — First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API

UNIT V PROGRAMMING MODEL 9

Introduction to Hadoop Framework — Map Reduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka

COURSE OUTCOMES:

- Employ the concepts of virtualization in the cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Identify the architecture of FOG and EDGE computing
- Develop the Cloud Application in AWS platform
- Develop services using various Cloud computing programming models.

TOTAL: 45 PERIODS

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1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly, 2010.
4. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
5. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing, MCGraw Hill Education (India) Pvt. Ltd., 2013.
6. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guide, McGraw-Hill Osborne Media, 2009.
7. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
8. John W.Ritting house and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
9. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	-	-	2	-	-	2	-	-	-	-	-	2	-	-	-
CO 2	-	3	3	-	-	-	-	3	-	-	-	-	2	3	-	-
CO 3	2	-	3	-	-	-	2	-	-	-	-	-	-	-	2	-
CO 4	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	2
CO 5	-	3	-	2	-	-	-	3	-	-	-	-	-	-	2	-
Average	2	3	3	2	-	2	2	3	-	-	-	-	2	3	2	2

CP3261 **INTERNET OF THINGS** **L T P C**

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COURSE OBJECTIVES:

- To understand the different architectures for IoT.
- To learn various protocols at the different layers for IoT.
- To develop prototype systems using Arduino / Rasberry Pi.
- To apply the use of data analytics in IoT.
- To develop applications of IoT in Industrial contexts.

UNIT I ARCHITECTURES AND MODELS **9**

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks.

UNIT II CONNECTIVITY **9**

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – ApplicationTransport Methods.

UNIT III SYSTEM DEVELOPMENT **9**

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV DATA ANALYTICS AND IoT SECURITY **9**

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics –Network Analytics, Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

UNIT V IoT IN INDUSTRY **9**

Manufacturing, Architecture, Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Use cases – Transportation, Architecture, Use cases.

TOTAL: 45 PERIODS

OUTCOMES:

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

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

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
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3. Michael Miller, “The Internet of Things”, Pearson Education, 2015.
4. Arshdeep Bahga, 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.

CO - PO and CO - PSO MAPPING

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	-	2	-	-	-	2	2	-	-	-	-	-	2	-
CO 2	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-	2
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CO 5	2	-	2	-	3	-	-	-	-	3	-	-	-	3	-	2
Average	2.4	2	2.5	2	3	-	-	2	2	3	-	-	3	3	2	2