Sri SAIRAM INSTITUTE OF TECHNOLOGY
An Autonomous Institution
West Tambaram, Chennai - 44
www.sairamit.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF
COMPUTER SCIENCE ENGINEERING
M.E BIG DATA ANALYTICS

REGULATIONS
2020

Academic Year 2020-21 onwards

AUTONOMOUS
CURRICULUM AND
SYLLABUS
I - IV
SEMESTERS

SRI SAIRAM INSTITUTE OF TECHNOLOGY

VISION

To be identified as a "Centre of Excellence" with high standards of Knowledge Dissemination and Research opportunities and to transform the students to imbibe qualities of technical expertise of international standards and high levels of ethical values, who in turn shall contribute to the advancement of society and human kind.

MISSION

We shall dedicate and commit ourselves to attain and maintain excellence in Technical Education through commitment and continuous improvement of infrastructure and equipment and provide an inspiring environment for Learning, Research and Innovation for our students to transform them into complete human beings with ethical and social values.

QUALITY POLICY

We at Sri Sai Ram Institute of Technology are committed to build a better nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Services to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To be a centre of excellence in educating and graduating Computer Engineers by providing unique environment that foster research, technological, and social enrichment with intellectual knowledge to acquire international standards.

MISSION

M1: Develop high quality Computer Science and Engineering graduates with technical and Professional skills by providing modern infrastructure to acquire international standards.

M2: Foster research to solve real world problems with emerging Technologies

M3: Establish center of excellences in collaboration with industries, to meet the changing needs of society

M4: Inculcate spirit of moral values that contributes to societal ethics

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20PBDMA101	Applied Probability And Statistics	3	1	0	4	4
2	20PBDPC101	Advanced Data Structures And Algorithms	3	0	0	3	3
3	20PBDPC102	Big Data Mining And Analytics	3	0	0	3	3
4	20PBDPC103	Multi Core Architecture	3	0	0	3	3
5	20PBDMC101	Research Methodology and IPR	2	0	0	2	2
6	20PBDMC102	Audit Course – I *	2	0	0	2	0
PRACTICALS							
7	20PBDPL101	Advanced Data Structures Lab	0	0	3	3	1.5
8	20PBDPL102	Big Data Computing Laboratory	0	0	3	3	1.5
		TOTAL				**23**	**18**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20PBDPC201	Foundations Of Data Science	3	1	0	4	4
2	20PBDPC202	Big Data Security	3	0	0	3	3
3	20PBDPC203	Machine Learning Techniques	3	0	0	3	3
4	20PBDPC204	NOSQL Database	3	0	0	3	3
5	20PXXELXXX	Professional Elective I	3	0	0	3	3
6	20PBDMC201	Audit Course – II*	2	0	0	2	0
PRACTICALS							
7	20PBDPL201	Big Data Query Languages Laboratory	0	0	3	3	1.5
8	20PBDPL202	Machine Learning Techniques Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - V							
9	20PBDTE201	Innovative Design Project	0	0	2	2	1
		TOTAL				**26**	**20**

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2020

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20PXXOEXXX	OPEN ELECTIVE	3	0	0	3	3
2	20PXXPEXXX	ELECTIVE II	3	0	2	5	4
3	20PXXELXXX	ELECTIVE III	3	0	0	3	3
4	20PXXELXXX	ELECTIVE IV	3	0	0	3	3
PRACTICAL							
5	20PBDPJ301	PROJECT WORK PHASE I	0	0	12	12	6
					TOTAL	**26**	**19**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
PRACTICAL							
1	20PBDPJ401	Project Work Phase II	0	0	24	24	12
					TOTAL	**24**	**12**

CREDIT DISTRIBUTION

Category	BS	PC	PL	TP	TE	EL	PJ
Credit	03	30	01	03	05	12	16

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20PBDEL201	High Performance Computing	3	0	0	3	3	Cloud Computing
2	20PBDEL202	Service Oriented Architecture	3	0	0	3	3	Cloud Computing
3	20PBDEL203	Information Retrieval Techniques	3	0	0	3	3	Data Science
4	20PBDEL204	Distributed Systems	3	0	0	3	3	Cloud Computing
5	20PBDEL205	Internet of Things	3	0	0	3	3	IoT

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20PBDEL301	Soft Computing	3	0	0	3	3	Cloud Computing
2	20PBDEL302	Multimedia Communication Networks	3	0	0	3	3	Cloud Computing
3	20PBDEL303	Parallel and Distributing Computing	3	0	0	3	3	Cloud Computing
4	20PBDEL304	Predictive Modelling	3	0	0	3	3	Data Science
5	20PBDEL305	Image Processing and Analysis	3	0	0	3	3	Data Science

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20PBDEL306	Deep Learning	3	0	0	3	3	Data Science
2	20PBDEL307	Cognitive Computing	3	0	0	3	3	Cloud Computing
3	20PBDEL308	Social Network Analysis	3	0	0	3	3	Cyber Security
4	20PBDEL309	Virtualization Techniques & Applications	3	0	0	3	3	Cloud Computing
5	20PBDEL310	Natural Language Processing	3	0	0	3	3	Data Science

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20PBDEL311	Data Intensive Computing		3	0	0	3 3	Data Science
2	20PBDEL312	R Language for Mining	3	0	0	3	3	Cloud Computing
3	20PBDEL313	Web Analytics	3	0	0	3	3	Cyber Security
4	20PBDEL314	Bioinformatics	3	0	0	3	3	Cloud Computing
5	20XXXELXXX	Statistics for Business Analytics	3	0	0	3	3	Data Science

AUDIT COURSES (AC)

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20PBDMC102	English for Research Paper Writing	2	0	0	0	0
2	20PBDMC103	Sanskrit for Technical Knowledge	2	0	0	0	0
3	20PBDMC104	Value Education	2	0	0	0	0
4	20PBDMC105	Pedagogy Studies	2	0	0	0	0
5	20PBDMC201	Disaster Management	2	0	0	0	0
6	20PBDMC202	Constitution of India	2	0	0	0	0
7	20PBDMC203	Stress Management by Yoga	2	0	0	0	0
8	20PBDMC204	Personality Development Through Life Enlightenment Skills	2	0	0	0	0
9	20PBDMC205	Unnat Bharat Abhiyan	2	0	0	0	0
					TOTAL	**0**	**0**

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Possess a mastery of Health safety and environment knowledge and safety management skills, to reach higher levels in their profession.

PEO 2 Knowledgeable safety Engineer rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements.

PEO 3 Well communicate the information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 An ability to become a knowledgeable safety Engineer rendering professional expertise to the industrial and societal needs subject to legal requirements.

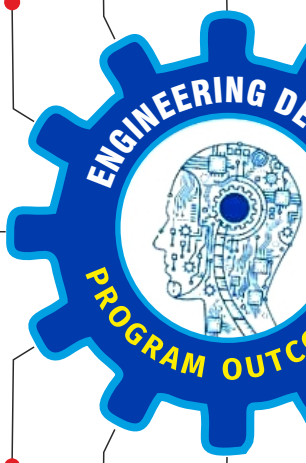
PSO2 An Ability to create a Health safety and environment facilitating collaboration with experts across various discipline.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences(BS)	17.4	31	29.5
Engineering Sciences(ES)	15.0	33	25.5
Humanities and Social Sciences (HS)	5.9	12	10
Professional Electives(EL)	7.1	12	12
Program Core+Program Lab (PC+PL)	36.5	76	62
Program theory with Lab (PW)	2.4	05	04
Open Electives (OE)	3.5	06	06
Talent Enhancement (TE)	2.4	08	04
Project (PJ)	4.1	14	07
Training & Placement (TP)	4.1	14	07
Internships/Seminars (IS)	1.8	-	03
Mandatory Courses (MC)	NA	06	NA
Total number of Credits		**217**	**170**

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



01 Engineering knowledge

Apply the basic principle and knowledge of mathematics, science and engineering principles to solve technical problems.

02 Problem Analysis

Identify and analyze complex engineering problems reaching logical conclusions using the basic principles of mathematics, science and engineering.

03 Development of solutions

Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs.

04 Investigate complex problems

Perform investigations, use research based knowledge and conduct experiments, analyze and interpret the results to provide valid conclusions.

05 Modern tool usage

Create, select and apply the latest techniques, resources and modern engineering / IT tools to develop appropriate solutions with an understanding of the limitations.

06 The Engineer and Society

Apply reasoning based on contextual knowledge to assess societal, legal and cultural issues with competency in professional engineering practices.

07 Environment & Sustainability

Demonstrate professional skills, knowledge and contextual reasoning to assess / environmental / societal issues for sustainable development.

08 Apply ethical principles

Apply ethical principles and commit to professional ethics and responsibilities based on the norms of professional engineering pratices.

09 Individual & Teamwork

Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary professional settings.

10 Communicate effectively

Communicate effectively amongst the engineering community, being able to comprehend & write effective reports, make presentations & give/receive clear instructions.

11 Project management

Demonstrate knowledge and apply the principles of engineering & management in their own / team projects in multidisciplinary environments.

12 Life-long learning

Recognize the need for, and have the preparation, ability to engage in independent and life-long learning in the context of technological change.

SEMESTER - I

20PBDMA101 SDG NO. 4	APPLIED PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide the solid foundation on topics in applied probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling.
- To introduce the basic concepts of Two dimensional random variables.
- To provide information about estimation theory.
- To learn the concepts of Correlation, Regression and Testing of testing of hypothesis.
- To address the issues and the principles of multivariate normal distribution and principle of components analysis.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT III ESTIMATION THEORY 9

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS 9

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 9

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal Components

Population principal components - Principal components from standardized variables.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Devore, J. L., —Probability and Statistics for Engineering and the Sciences‖, 8th Edition, Cengage Learning, 2014.
2. Dallas E. Johnson, —Applied Multivariate Methods for Data Analysis‖, Thomson and Duxbury press, 1998.
3. Gupta S.C. and Kapoor V.K.,‖ Fundamentals of Mathematical Statistics‖, Sultan and Sons, New Delhi, 2001.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.
5. Richard A. Johnson and Dean W. Wichern, —Applied Multivariate Statistical Analysis‖, 5th Edition, Pearson Education, Asia, 2002.

REFERENCES:

1. Milton. J. S. and Arnold. J.C., “Introduction to Probability and Statistics”, Tata McGraw Hill, 4 th Edition, 2007.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.
3. Papoulis. A and Unnikrishnapillai. S., “Probability, Random Variables and Stochastic Processes ” McGraw Hill Education India , 4th Edition, New Delhi , 2010.

OUTCOMES:

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

1. Basic probability axioms and rules and the moments of discrete and Continuous random variables.
2. Consistency, efficiency and unbiasedness of estimators, method of Maximum likelihood estimation and Central Limit Theorem.
3. Use statistical tests in testing hypotheses on data.
4. Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.
5. The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

CO – PO, PSO MAPPING:

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

SEMESTER - I

20PBDPC101 SDG NO. 4,8,9	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of analysis of algorithm
- To understand the various Heap data structures
- To learn a variety of useful data structures and algorithms for Searching
- To understand the geometric algorithms and parallel algorithms
- To apply the algorithms and techniques to solve various problems

UNIT I FUNDAMENTALS **9**

Mathematical Proof Techniques: Induction, proof by contradiction, direct proofs – Asymptotic Notations – Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Introduction to NP-Completeness/NP-Hard – Recurrence Equations – Solving Recurrence Equations – Time-Space Tradeoff.

UNIT II HEAP STRUCTURES **9**

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps – Lazy-Binomial Heaps.

UNIT III SEARCH STRUCTURES **9**

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

UNIT IV GEOMETRIC ALGORITHMS **9**

Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection – Convex Hulls – Computing the Overlay of Two Subdivisions – Range Trees – Voronoi Diagram

UNIT V PARALLEL ALGORITHMS **9**

Flynn's Classifications – List Ranking – Prefix computation – Array Max – Sorting on EREW ,PRAM – Sorting on Mesh and Butterfly – Prefix sum on Mesh and Butterfly – Sum on mesh and butterfly – Matrix Multiplication – Data Distribution on EREW, Mesh and Butterfly

TOTAL: 45 PERIODS

REFERENCES:

1. Ellis Horowitz, SartajSahni, Dinesh Mehta, "Fundamentals of Data Structures in C", Silicon Pr, 2007.
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, 2008.
3. J.A. Storer, "An Introduction to Data Structures and Algorithms", Birkhäuser Boston, 2002.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2009. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
5. Jeremy Howard, Margit Zwemer, Mike Loukides, "Designing Great Data Products- Inside the Drivetrain Approach, a Four-Step Process for Building Data Products – Ebook", 1st Edition, O'Reilly Media, March 2012.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/advanced-data-structures
2. https://courses.csail.mit.edu/6.851/

ONLINE RESOURCES:

1. https://www.freebookcentre.net/ComputerScience-Books-Download/Advanced-Data-Structures.html
2. http://pages.cs.wisc.edu/~shuchi/courses/787-F07/ scribe-notes/ All-in-one.pdf

OUTCOMES:

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

1. Analyze the algorithmic efficiency of an algorithm
2. Implement the various Heap and Search Data Structure
3. Use geometric algorithm to solve computational problems
4. Describe the parallel algorithm for parallel processing
5. Apply the various data structures and algorithms to solve problems

CO-PO & PSO MAPPING:

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

SEMESTER - I

20PBDPC102 SDG NO. 4	BIG DATA MINING AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the computational approaches to Modelling, 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

TEXT BOOKS:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
2. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.

REFERENCES:

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

OUTCOMES :

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

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

CO - PO, PSO MAPPING :

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

SEMESTER - I

PBDPC103 SDG NO. 4,9	MULTI CORE ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters
- To understand the different multiprocessor issues
- To expose the different types of multicore architectures
- To understand the design of the memory hierarchy

UNIT I FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era.

UNIT II MEMORY HIERARCHY DESIGN 9

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III MULTIPROCESSOR ISSUES 9

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers, Cloud Computing – Architectures and Issues – Case Studies.

UNIT V VECTOR, SIMD AND GPU ARCHITECTURES 9

Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.

REFERENCES:

1. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010.
3. Wen– mei W. Hwu, "GPU Computing Gems", Morgan Kaufmann / Elsevier, 2011.

WEB REFERENCES

1. https://www.youtube.com/watch?v=nF3kr5KvUno
2. https://www.globalspec.com/reference/71417/203279/chapter-1-introduction-to-multi-core-architecture

OUTCOMES:

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

1. Identify the limitations of ILP and the need for multicore architectures
2. Discuss the issues related to multiprocessing and suggest solutions
3. Critically analyze the different types of inter connection networks
4. Point out the salient features of different multicore architectures and how they exploit parallelism
5. Design a memory hierarchy and optimize it

CO – PO, PSO MAPPING:

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

SEMESTER - I

20PBDMC101 SDG NO. 4&9	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge and skills required for research and IPR
- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION 6

Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II LITERATURE REVIEW 6

Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICALWRITING /PRESENTATION 6

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 6

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) 6

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 30 PERIODS

REFERENCES:

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010

OUTCOMES:

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

1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D

CO- PO, PSO MAPPING:

SEMESTER - I

20PBDPL101 SDG NO. 4,6,7, 9, 12,14 &15	ADVANCED DATA STRUCTURES LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand heap and various tree structures like AVL, Red-black, B and Segment trees
- To understand the problems such as line segment intersection, convex shell and Voronoi diagram

LIST OF EXPERIMENTS:

1. Min/Max Heap
2. Leftist Heap
3. AVL Trees
4. Red-Black Trees
5. B-Trees

6. Segment Trees
7. Line segment intersection
8. Convex Hull
9. Voronoi Diagram

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 18 STUDENTS:

Standalone desktops with C compiler, C++ compiler 18 Nos.

(Or)

Server with C compiler, C++ supporting 18 terminals or more.

OUTCOMES:

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

1. Implement heap and various tree structure like AVL, Red-black, B and Segment trees
2. Implement List ADTs and their operations.
3. Solve the problems such as line segment intersection, convex shell and Voronoi diagram
4. Develop programs for sorting, implementing trees and their traversal operations.
5. Apply algorithm design techniques

CO, PO, PSO MAPPING:

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

SEMESTER - I

20PBDPL102 SDG NO. 4	BIG DATA COMPUTING LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To set up single and multi-node Hadoop Clusters.
- To solve Big Data problems using Map Reduce Technique.
- To learn NoSQL query.
- To design algorithms that uses Map Reduce Technique to apply on Unstructured and structured data.
- To learn Scalable machine learning using Mahout

LIST OF EXERCISES:

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using map reduce
5. Page Rank Computation
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries

TOTAL: 60 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Each of the 21 servers in the VMWARE ESXi Cluster consists of:
IBM X3650 M4 Big Data model
Hadoop software
Installation of PIG,HIVE

OUTCOMES:

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

1. Set up single and multi-node Hadoop Clusters.
2. Apply Map Reduce technique for various algorithms.

3. Design new algorithms that uses Map Reduce to apply on Unstructured and structured data.
4. Develop Scalable machine learning algorithms for various Big data applications using Mahout.
5. Represent NoSQL data.

CO- PO, PSO MAPPING:

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

SEMESTER - II

20PBDPC201 SDG NO. 4	FOUNDATION OF DATA SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Able to apply fundamental algorithmic ideas to process data.
- Learn to apply hypotheses and data into actionable predictions.
- Document and transfer the results and effectively communicate the findings using visualization techniques.

UNIT I INTRODUCTION TO DATA SCIENCE **9**

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

UNIT II MODELING METHOD **9**

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

UNIT III INTRODUCTION TO R **9**

Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

UNIT IV MAP REDUCE **9**

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

UNIT V DELIVERING RESULTS **9**

Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate

data – matrix plots – multiple plots in one window - exporting graph - using graphics parameters. Case studies

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.

REFERENCES:

1. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
2. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley &Sons, Inc., 2012.
3. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013
4. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical DataScience Cookbook", Packet Publishing Ltd., 2014.
5. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, andStatistics", Wiley, 2011.
6. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions",Wiley, ISBN: 9788126551071, 2015.

WEB REFERENCES:

1. http://www.johndcook.com/R_language_for_programmers.html
2. http://bigdatauniversity.com/
3. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction

ONLINE RESOURCES:

1. https://freevideolectures.com/search/foundation-of-data-science/
2. https://www.simplilearn.com/big-data-and-analytics/senior-data-scientist-masters-program-training

OUTCOMES:

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

1. Obtain, clean/process and transform data.
2. Analyze and interpret data using an ethically responsible approach.
3. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.

4. Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges.

CO- PO,PSO MAPPING:

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

SEMESTER - II

20PBDPC202 SDG NO. 4 & 9	BIG DATA SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the mathematical foundations of security principles
- To appreciate the different aspects of encryption techniques
- To understand the role played by authentication in security
- To understand the security concerns of big-data.

UNIT I SYMMETRIC TECHNIQUES 9

Probability and Information Theory - Algebraic foundations – Number theory - Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES – Confidentiality Modes of Operation

UNIT II ASYMMETRIC TECHNIQUES 9

Diffie-Hellman Key Exchange protocol – Discrete logarithm problem – RSA cryptosystems & cryptanalysis – ElGamal cryptosystem – Elliptic curve architecture and cryptography - Data Integrity techniques.

UNIT III AUTHENTICATION 9

Authentication requirements – Authentication functions – Message authentication codes – Hash functions – Security of hash functions and MACS – MD5 Message Digest algorithm – Secure hash algorithm.

UNIT IV SECURITY ANALYTICS I 9

Introduction to Security Analytics – Techniques in Analytics – Analysis in everyday life –Challenges in Intrusion and Incident Identification – Analysis of Log file – Simulation and Security Process.

UNIT V SECURITY ANALYTICS II 9

Access Analytics – Security Analysis with Text Mining – Security Intelligence – Security Breaches

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2008. (Unit 1 and 3)
2. Thomas Erl, " Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005 (Unit 2, 3, 4, and 5)
3. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002 (Unit 5)

REFERENCES:

1. William Stallings, "Crpyptography and Network security: Principles and Practices",Pearson/PHI, 5th Edition, 2010.
2. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw Hill Education,2nd Edition, 2010.
3. Douglas R. Stinson ,"Cryptography Theory and Practice ", Chapman & Hall/CRC, 3rd Edition, 2006.
4. Mark Talabis, Robert McPherson, I Miyamoto and Jason Martin, "Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data",Syngress Media, U.S., 2014

WEB REFERENCES:

1. http://www.smartercomputingblog.com/category/big-data/
2. https://www.rd-alliance.org/group/big-data-ig-data-security-and-trust-wg/wiki/big-data-security-issues-challenges-tech-concerns

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/big_data_tutorials.htm
2. https://www.simplilearn.com/tutorials/big-data-tutorial

OUTCOMES:

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

1. Design algorithms in a secure manner for Big data applications
2. Use available security practices in big-data analytics.
3. Mathematical foundations of security principles and different aspects of encryption techniques
4. To Study the Role played by authentication in security
5. Security concerns of big-data

CO - PO,PSO MAPPING:

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

SEMESTER - II

20PBDPC203 SDG NO. 4 & 9	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of machine learning
- To appreciate supervised and unsupervised learning and their applications
- To understand the theoretical and practical aspects of Probabilistic Graphical Models
- To appreciate the concepts and algorithms of reinforcement learning
- To learn aspects of computational learning theory

UNIT I INTRODUCTION **8**

Machine Learning - Machine Learning Foundations –Overview – Design of a Learning system - Types of machine learning –Applications Mathematical foundations of machine learning - random variables and probabilities - Probability Theory – Probability distributions -Decision Theory- Bayes Decision Theory - Information Theory

UNIT II SUPERVISED LEARNING **10**

Linear Models for Regression - Linear Models for Classification – Naïve Bayes - Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- egression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Back- propagation. Support vector machines - Ensemble methods- Bagging- Boosting.

UNIT III UNSUPERVISED LEARNING **8**

Clustering- K-means - EM Algorithm- Mixtures of Gaussians. The Curse of Dimensionality Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT IVPROBABILISTIC GRAPHICAL MODELS **10**

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models -Bayesian Networks - Conditional independence properties - Inference – Learning- Generalization - Hidden Markov Models - Conditional random fields (CRFs)

UNIT V ADVANCED LEARNING **9**

Sampling –Basic sampling methods – Monte Carlo. Reinforcement Learning- K-Armed Bandit- Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning- Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting

TOTAL: 45 PERIODS

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.

4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
6. Stephen Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106139/
2. https://nptel.ac.in/courses/106106202/
3. https://www.udemy.com/course/machinelearning/
4. https://www.edx.org/learn/machine-learning

ONLINE RESOURCES:

1. https://deepakdvallur.weebly.com/machine-learning.html
2. https://www.tutorialsduniya.com/notes/
3. https://ai.stanford.edu/~nilsson/MLBOOK.pdf

OUTCOMES:

At the end of the course, the students should able to

1. Design a neural network for an application of your choice
2. Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results
3. Use a tool to implement typical clustering algorithms for different types of applications
4. Design and implement an HMM for a sequence model type of application
5. Identify applications suitable for different types of machine learning with suitable justification

CO - PO,PSO MAPPING:

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

SEMESTER - II

20PBDPC204 SDG NO. 4, 9	NoSQL DATABASE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To define, compare and use the four types of NoSQL Databases
- To demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- To Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

UNIT I INTRODUCTION TO NoSQL DATABASES 9

Overview of NoSQL Databases -Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Aggregate-Oriented Databases.

UNIT II `DATABASE FOR MODERN WEB 9

Replication and sharding, Map Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication Document Databases ,Scaling, Suitable Use Cases,Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT III COLUMN- ORIENTED NOSQL DATABASES 9

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platfo rms, Counters, Expiring Usage.

UNIT IV KEYVALUE DATABASE DESIGNS 9

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.

UNIT V GRAPH DATABASE DESIGN **9**

Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Sadalage", P. & Fowler , Pearson Education

REFERENCE BOOKS:

1. "A Guide to Modern Databases and the NoSQL Movement Edition," Redmond, E. &Wilson,1st Edition. Chodorow, K. (2013).
2. "MongoDB: The Definitive Guide (2nd ed.). Upper Saddle River", NJ: Pearson Education, Inc. ISBN-13: 978-1449344689 ISBN-10: 1449344682.

WEB REFERENCES:

1. https://www.mongodb.com/nosql-explained
2. https://en.wikipedia.org/wiki/NoSQL
3. https://docs.microsoft.com/en-us/dotnet/architecture/microservices/microservice-ddd-cqrs-patterns/nosql-database-persistence infrastructure

ONLINE RESOURCES:

1. https://www.w3resource.com/mongodb/nosql.php
2. https://www.couchbase.com/resources/why-nosql

OUTCOMES:

Upon successful completion of this course, student should be able to

1. Demonstrate an understanding of installing MongoDB.
2. Explain the techniques used to create, insert, update and delete data/documents.
3. Demonstrate the various techniques used to query the database.
4. Explain the techniques to optimize querying using indexing.
5. Explain the technique of splitting data across machines via sharding.

CO - PO, PSO MAPPING :

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

SEMESTER - II

20PBDPL201 SDG NO. 4&9	BIG DATA QUERY LANGUAGES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the basic programming constructs of R and understand the use of R in Big Data analytics.
- To solve Big data problems using Map Reduce Technique in R, HADOOP.
- To develop Pig scripts for analyzing large un-structured and semi-structured data.
- To develop program for Query processing using Hive.
- To perform analytics on Big data streams using Hadoop Streaming API.To learn to work on Sqoop

LIST OF EXPERIMENTS:

1. Perform descriptive and predictive analytics using "R programming"
2. MapReduce application for word counting on R HADOOP after successful installation of three R packages(rhdfs, rmr, and rhbase)
3. Understand data pipeline using Pig Interactive Shell Commands after successful "Pig" installation
4. Develop Pig Scripts and call UDF's to accomplish functionalities to meet the problem objectives
5. Embedding PIG Latin in Python
6. Log analysis using "Pig" on semi structured data

7. Perform query processing on data warehousing after successful installation of "Hive"
8. Perform adhoc query on HDFS data using Hive Query Language (HQL)
9. Accomplish MapReduce Job by using Hadoop Streaming API
10. Perform various HDFS commands
11. Loading data into HDFS using Sqoop

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Set up R packages and develop a program using R Programming constructs.
2. Solve Big Data problems using RHADOOP.
3. Understand setting up of Pig and solve Big Data problems.
4. Understand setting up of Hive and perform query processing.
5. Apply Hadoop Streaming API for Big Data problems.

CO- PO, PSO MAPPING:

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

SEMESTER - II

20PBDPL202 SDG NO. 4 & 9	MACHINE LEARNING TECHNIQUES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To apply the concepts of Machine Learning to solve real-world problems
- To implement basic algorithms in clustering & classification applied to text & numeric data
- To implement algorithms emphasizing the importance of bagging & boosting in classification & regression

- To implement algorithms related to dimensionality reduction
- To apply machine learning algorithms for Natural Language Processing applications

EXERCISES RECOMMENDED:

1. Solving Regression & Classification using Decision Trees
2. Root Node Attribute Selection for Decision Trees using Information Gain
3. Bayesian Inference in Gene Expression Analysis
4. Pattern Recognition Application using Bayesian Inference
5. Bagging in Classification
6. Bagging, Boosting applications using Regression Trees
7. Data & Text Classification using Neural Networks
8. Using Weka tool for SVM classification for chosen domain application
9. Data & Text Clustering using K-means algorithm
10. Data & Text Clustering using Gaussian Mixture Models
11. Dimensionality Reduction Algorithms in Image Processing applications
12. Application of CRFs in Natural Language Processing

TOTAL: 45 PERIODS

OUTCOMES:

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

1. To learn to use Weka tool for implementing machine learning algorithms related to numeric data
2. To learn the application of machine learning algorithms for text data
3. To use dimensionality reduction algorithms for image processing applications
4. To apply CRFs in text processing applications
5. To use fundamental and advanced neural network algorithms for solving real-world data

CO- PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES I

20PBDEL201 SDG NO. 4 & 9	HIGH PERFORMANCE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts of High Performance Computing.
- To learn the network & software infrastructure for high performance computing.
- To understand the real time analytics using high performance computing.
- To learn the different ways of security perspectives and technologies used in HPC.
- To understand the emerging big data applications.

UNIT I INTRODUCTION 9

The Emerging IT Trends- IOT/IOE-Apache Hadoop for big data analytics-Big data into big insights and actions – Emergence of BDA discipline – strategic implications of big data – BDA Challenges – HPC paradigms – Cluster computing – Grid Computing – Cloud computing – Heterogeneous computing – Mainframes for HPC - Supercomputing for BDA – Appliances for BDA.

UNIT II NETWORK & SOFTWARE INFRASTRUCTURE FOR HIGH PERFORMANCE BDA 9

Design of Network Infrastructure for high performance BDA – Network Virtualization – Software Defined Networking – Network Functions Virtualization – WAN optimization for transfer of big data – started with SANs-storage infrastructure requirements for storing big data – FC SAN – IP SAN – NAS – GFS – Panasas – Luster file system – Introduction to cloud storage.

UNIT III REAL TIME ANALYTICS USING HIGH PERFORMANCE COMPUTING 9

Technologies that support Real time analytics – MOA: Massive online analysis – GPFS: General parallel file system – Client case studies – Key distinctions – Machine data analytics – operational analytics – HPC Architecture models – In Database analytics – In memory analytics

UNIT IV SECURITY AND TECHNOLOGIES 9

Security, Privacy and Trust for user – generated content: The challenges and solutions – Role of real time big data processing in the IOT's – End to End Security Framework for big sensing data streams – Clustering in big data.

UNIT V EMERGING BIG DATA APPLICATIONS 9

Deep learning Accelerators – Accelerators for clustering applications in machine learning - Accelerators for classification algorithms in machine learning – Accelerators for Big data Genome Sequencing

TOTAL: 45 PERIODS

TEXT BOOKS:

1. "High-Performance Big-Data Analytics: Computing Systems and Approaches", 2015 Edition, Springer
2. "Big Data Management and Processing", Kuan-Ching Li , Hai Jiang, Albert Y. Zomaya, CRC Press.
3. "High Performance Computing for Big Data: Methodologies and Applications", Chao wang ,CRC Press

REFERENCES:

1. "High-Performance Data Mining And Big Data Analytics" , Khosrow Hassibi, Create Space Independent Publishing Platform
2. "High performance computing: Modern systems and practices", Thomas Sterling, Matthew Anderson, Morgan Kaufmann publishers.

WEB REFERENCES:

1. https://www.hpcwire.com/

ONLINE RESOURCES:

1. http://hpc.fs.uni-lj.si/sites/default/files/HPC_for_dummies.pdf
2. https://www.nics.tennessee.edu/computing-resources/what-is-hpc

OUTCOMES

On completion of the laboratory course, the student should be able to

1. Understand the basics concepts of High Performance computing systems.
2. Apply the concepts of network and software infrastructure for high performance computing
3. Use the real time analytics using high performance computing.
4. Apply the security models and big data applications in high performance computing
5. Understand the emerging big data applications.

CO- PO,PSO MAPPING

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

PROFESSIONAL ELECTIVES I

20PBDEL202 SDG NO. 4, 9, 11	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an overview of XML Technology and modeling databases in XML
- Understand the key principles behind SOA.
- Be familiar with the web services technology elements for realizing SOA.
- To introduce Security Standards and Solutions in XML and Web Services

UNIT I XML Technology **9**

XML – XML and Web - Name Spaces – XML Document Structure - Structuring with Schemas and DTD - Modeling Databases in XML – XQuery

UNIT II SOA Basics **9**

Service Oriented Architecture (SOA) – Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA – Benefits of SOA -- Principles of Service orientation –Service layers - Business Process management

UNIT III Web Services (WS) **9**

SOA and Web Services – Web Services Protocol Stack – Service descriptions – WSDL –Messaging with SOAP – Service discovery – UDDI. Service-Level Interaction patterns – XML and Web Services - Enterprise Service Bus - .NET and J2EE Interoperability.

UNIT IV WS Technologies and Standards 9

Web Services Technologies - JAX-RPC, JAX-WS. Web Service Standards – WS-RM, WS-Addressing, WS-Policy. Service Orchestration and Choreography – Composition Standards -BPEL. Service Oriented Analysis and Design.

UNIT V XML and WS Security 9

XML Security Overview – Canonicalization – XML Security Framework – XML Encryption –XML Signature – XKMS Structure. Web Services Security - XACML - WS-Security.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2008. (Unit 1 and 3)
2. Thomas Erl, " Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005 (Unit 2, 3, 4, and 5)
3. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002(Unit 5)

REFERENCES:

1. "High-Performance Data Mining And Big Data Analytics" , Khosrow Hassibi, Create Space Independent Publishing Platform
2. "High performance computing: Modern systems and practices", Thomas Sterling, Matthew Anderson, Morgan Kaufmann publishers.

REFERENCE BOOKS:

1. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", AddisonWesley, 2005.
2. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2011.
3. Mark O' Neill, et al., "Web Services Security", Tata McGraw-Hill Edition, 2003.
4. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004

WEB REFERENCES:

1. https://books.google.co.in/books/about/Understanding_SOA_with_Web_Services.html?id=WupSAAAAMAAJ
2. https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6
3. https://books.google.co.in/books/about/Developing_Enterprise_Web_Services.html?id=LEpPzQ5mRDoC

ONLINE RESOURCES:

1. https://www.opengroup.org/soa/source-book/soa_refarch/index.htm
2. https://www.javatpoint.com/service-oriented-architecture

OUTCOMES

On completion of the laboratory course, the student should be able to

1. Understand the basics of XML technology
2. Learn the Basic concepts of SOA and understand the applicability of SOA design patterns
3. Design, develop and test Web services
4. Evaluate emerging and proposed standards for the main components of Web services architectures.
5. Learn the approaches for providing security for XML documents as well as messages exchanged among Web Services.

CO- PO,PSO MAPPING

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

PROFESSIONAL ELECTIVES I

20PBDEL203 SDG NO. 4	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 get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- 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 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 CLASSIFICATION AND CLUSTERING 9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning

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

REFERENCES:

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The concepts and Technology behind Search" (ACM Press Books), Second Edition, 2011.
2. Christopher D. Manning, Prabhakar Raghavan, HinrichSchutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008.
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010

WEB REFERENCES:

1. https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets /
2. http://web.stanford.edu/class/cs276/

ONLINE RESOURCES:

1. https://www.youtube.com/playlist?list=PL0ZVw5-GryEkGAQT7lX7oIHqyDPeUyOMQ
2. https://nlp.stanford.edu/IR-book/newslides.html

OUTCOMES

On completion of the laboratory course, the student should be able to

1. Build an Information Retrieval system using the available tools
2. Identify and design the various components of an Information Retrieval system
3. Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
4. Design an efficient search engine
5. To analyze the Web content structure

CO- PO,PSO MAPPING

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

PROFESSIONAL ELECTIVES I

20PBDEL204 SDG NO. 4, 9 & 11	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand foundations of Distributed Systems, Challenges & Examples
- Understand the Distributed shared memory and file system.
- Understand the issues in scheduling and deadlock
- Understand Distributed database and multimedia.

UNIT I INTRODUCTION TO DISTRIBUTED SYSTEMS 9

Architecture for Distributed System, Goals of Distributed system, Hardware and Software concepts, Distributed Computing Model, Advantages & Disadvantage distributed system, Issues in designing Distributed System

UNIT II DISTRIBUTED SHARE MEMORY AND DISTRIBUTED FILE SYSTEM 9

Basic Concept of Distributed Share Memory (DSM), DSM Architecture & its Types, Design & Implementations issues In DSM System, Structure of Share Memory Space, Consistency Model, and Thrashing. Desirable features of good Distributed File System, File Model, File Service Architecture, File Accessing Model, File Sharing Semantics, File Catching Scheme, File Application & Fault tolerance. Naming: - Features, System Oriented Names, Object Locating Mechanism, Human Oriented Name.

UNIT III INTER PROCESS COMMUNICATION AND SYNCHRONIZATION 9

API for Internet Protocol, Data Representation & Marshaling, Group Communication, Client Server Communication, RPC- Implementing RPC Mechanism, Stub Generation, RPC Messages. Synchronization: - Clock Synchronization, Mutual Exclusion, Election Algorithms:- Bully & Ring Algorithms.

UNIT IV DISTRIBUTED SCHEDULING AND DEADLOCK 9

Distributed Scheduling-Issues in Load Distributing, Components for Load Distributing Algorithms, Different Types of Load Distributing Algorithms, Task Migration and its issues. Deadlock-Issues in deadlock detection & Resolutions, Deadlock Handling Strategy, Distributed Deadlock Algorithms

UNIT V DISTRIBUTED MULTIMEDIA & DATABASE SYSTEM 9

Distributed Data Base Management System(DDBMS), Types of Distributed Database, Distributed Multimedia:- Characteristics of multimedia Data, Quality of Service Managements. Case Study of Distributed System:- Amoeba, Mach, Chorus

TOTAL: 45 PERIODS

TEXT BOOK:

1. Pradeep K Sinha, "Distributed Operating System Concepts & Design", PHI, 2012.

REFERENCES:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Singhal & Shivratari, "Advance Concept in Operating System", McGraw Hill Attiya & Welch, Distributed Computing, Wiley Pub.
3. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
4. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.

WEB REFERENCES:

1. https://link.springer.com/book/10.1007/978-3-658-14842-3#about
2. https://www.udemy.com/course/distributed-systems-cloudcomputing-with-java/

ONLINE RESOURCES:

1. https://books.google.co.in/books?id=bJ3DgAAQBAJ&pg=PR4&source=kp_read_button&redir_esc=y#v=onepage&q&f=false
2. https://books.google.co.in/books/about/Distributed_Computing.html?id=G7SZ32dPuLgC&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false

OUTCOMES:

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

1. Identify the design issues specific to distributed systems.
2. Demonstrate the structure of the shared memory space and Distributed File system models.
3. Apply Inter process communication and synchronization
4. Apply Distributed scheduling and Deadlock
5. Apply Distributed multimedia and Database system

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVES I

20PBDEL205 SDG NO. 9	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT **9**

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN & DEVELOPMENT 9

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS

TEXT BOOK:

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

REFERENCES:

1. Arshdeep Bahga,Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi ,—The Internet ofThings – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , 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.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

WEB REFRENCES:

1. https://www.hindawi.com/journals/jece/2017/9324035/
2. https://www.iotforall.com/glossary-iot-standards-and-protocols/

ONLINE RESOURCES:

1. https://www.javatpoint.com/iot-internet-of-things
2. https://www.tutorialspoint.com/internet_of_things/index.htm

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Explain the concept of IoT.
2. Analyze various protocols for IoT.
3. Design a PoC of an IoT system using Rasperry Pi/Arduino
4. Apply data analytics and use cloud offerings related to IoT.
5. Analyze applications of IoT in real time scenario

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVES II

20PBDEL301 SDG NO. 4	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the key aspects of soft computing and neural networks
- To study the fuzzy logic components
- To gain insight onto neuro-fuzzy modelling and control
- To know about the components and building block hypothesis of genetic algorithm
- To gain knowledge in machine learning through Support Vector Machines

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Evolution of Computing - Soft Computing Constituents – From Conventional AI toComputational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS 9

Introduction to Genetic Algorithms (GA) – Applications of GA - Building block hypothesis-Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning.

UNIT III NEURAL NETWORKS 9

Machine learning using Neural Network, Adaptive Networks – Feed Forward Networks –Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures –Advances in Neural Networks.

UNIT IV FUZZY LOGIC 9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – ClassificationAnd Regression Trees – Data Clustering Algorithms – Rule base Structure Identification –Neuro-Fuzzy Control – Case Studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES:

1. KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.
4. David E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1989.
5. Mitchell Melanie, "An Introduction to Genetic Algorithm", MIT Press, 1996.

WEB REFERENCES:

1. https://www.sciencedirect.com/science/article/pii/S1877050916325467
2. https://towardsdatascience.com/soft-computing-6cef872f7704

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc20_cs17/preview

OUTCOMES:

Upon completion of this course, the student should be able to

1. Discuss on machine learning through neural networks
2. Apply knowledge in developing a Fuzzy expert system
3. Model Neuro Fuzzy system for clustering and classification
4. Discover knowledge to develop Genetic Algorithm
5. Support vector machine based machine learning system

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVES II

20PBDPE302 SDG NO. 4, 9	MULTIMEDIA COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of multimedia communication networks.
- To learn the different architecture & layers used in multimedia support services.
- To understand the wireless and mobile multimedia networks.
- To understand the real time software architecture for multimedia communication and management.

UNIT I INTRODUCTION 9

Fundamentals of communications - Present and future telecommunications - Multimedia communication Networks - Motivation for multimedia communications - Evolution of telecommunication networks - trends and driving forces in multimedia communications - services - Digital network library system -Multimedia teleconferencing system - super high definition image system - Video on demand/ Multimedia on demand system.

UNIT II QOS ARCHITECTURE & LAYERS USED IN MULTIMEDIA SUPPORT 9

Qos Framework - Architecture - Traffic Modelling - Traffic Management - Designing ATM Switches - ATM Switch Architecture - Multicast ATM Switches - Transport Network Architecture And Technologies For Multimedia Services - Operations, Administrations And Management In The Multimedia Era.

UNIT III WIRELESS AND MOBILE MULTIMEDIA NETWORKS 9

Introduction - Multimedia Challenges in wireless & mobile systems - Multimedia technologies and devices - wireless communications and mobile networking technology - QOS for multimedia applications - Integration of wireless and wire line networks - future directions in wireless multimedia.

UNIT IV SOFTWARE ARCHITECTURE FOR MULTIMEDIA COMMUNICATION AND MANAGEMENT AND STANDARDS 9

Multimedia OS- Middleware and RM-ODP - CORBA - multimedia on distributed platforms - Multimedia in CORBA - Multimedia in JAVA - Using ODP for designing distributed multimedia applications - Telecommunication and Information Standardization organizations - Forums & Consortia- GII related activities.

UNIT V SECURITY 9

Security Considerations For Multimedia - Service Provider Perspective - User Perspective - Legal And Government Perspective - Network Security Issues - Security Analysis Guidelines And Models - Network Security Services - Security Aspects Of ATM Networks - Security Aspects Of IP Networks- Intelligent Network - Industry Standards And Organizations

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mallikarjun Tatipamula, Bhumip Khasnabish, "Multimedia Communications Networks Technologies and Services", Artech House Publishers, 1998.
2. Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press,1 edition, 2012.

REFERENCES:

1. Fred Halsall, "Multimedia communications: Applications, Networks, Protocols and Standards", PEARSON, 1st Edition, 2015.
2. Jerry Gibson, "Multimedia Communications, Directions & Innovations", Academic Press,1 edition ,2000.

WEB REFERENCES:

1. https://nptel.ac.in/courses/117105083/
2. www.webopedia.com/TERM/N/network.html

ONLINE RESOURCES:

1. https://nptel.ac.in/content/storage2/courses/117105083/pdf/ssg_m1l1.pdf
2. https://swayam.gov.in/nd1_noc20_ee33/preview

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the basics structure of multimedia communication systems.
2. Apply the concepts of Qos & wireless and mobile multimedia networks.
3. Use the software architecture for multimedia communication.
4. Apply the security models in the multimedia communication environment
5. Implement various standards for multimedia communication systems.

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVES II

20PBDEL303 SDG NO. 4	PARALLEL AND DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Select the appropriate parallel programming model for the given application.
- To practice the constructs of parallel programming model to convert a sequential program to parallel program.
- To Develop parallel programs using Open MP and MPI constructs
- Study software components of distributed computing systems. Know about the communication and interconnection architecture of multiple computer systems.
- Recognize the inherent difficulties that arise due to distributedness of computing resources. Understanding of networks & protocols, mobile & wireless computing and their applications to real world problems.

UNIT I FUNDAMENTALS **9**

Introduction to Parallel and Distributed Computing - Parallel and Distributed Architectures, Socket programming - Parallel Performance, Shared Memory and Threads – Parallel Algorithms - Parallel Algorithms, OpenMP - Scalable Algorithms, Message Passing - Parallel,work sharing and Synchronization constructs. MPI data types and tags, environment management routines. Data level parallelism - Vector architecture- Graphics processing units- Programming the GPU.

UNIT II PROCESS AND DISTRIBUTED OBJECTS **9**

Characterization of Distributed Systems – Examples – Resource Sharing and the Web –Challenges – System Models – Architectural and Fundamental Models – Networking and Internetworking – Types of Networks – Network Principles – External Data Representation and Marshalling – Client–Server Communication – Group Communication – Case Study –Distributed Objects and Remote Invocation – Communication between Distributed Objects –Remote Procedure Call

UNIT III OPERATING SYSTEM ISSUES I **9**

The OS Layer – Protection – Processes and Threads – Communication and Invocation – OS Architecture – Security – Overview – Cryptographic Algorithms – Digital Signatures –Cryptography Pragmatics – Case Studies – Distributed File Systems – File Service Architecture.

UNIT IV OPERATING SYSTEM ISSUES II **9**

Name Services – Domain Name System – Directory and Discovery Services – Global Name Service – X.500 Directory Service – Clocks – Events and Process States – Synchronizing Physical Clocks – Logical Time and Logical Clocks – Global States – Distributed Debugging– Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

UNIT V DISTRIBUTED TRANSACTION PROCESSING **9**

Transactions – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering – Comparison – Flat and Nested Distributed Transactions – Atomic Commit Protocols – Concurrency Control in Distributed Transactions – Distributed Deadlocks –Transaction Recovery – Overview of Replication and Distributed Multimedia Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David E. Culler, Jaswinder Pal Singh, —Parallel Computing Architecture : A Hardware/Software Approach|| , Morgan Kaufmann / Elsevier Science (reprint Technical Science &Engineering) , 2009
2. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts andDesign", Pearson Education, 3rd Edition, 2002.
3. SapeMullender, "Distributed Systems", Addison Wesley, 2nd Edition, 1993.

REFERENCES:

1. Albert Fleishman, "Distributed Systems Software Design and Implementation", SpringerVerlag, 1994.
2. M. L .Liu, "Distributed Computing Principles and Applications", Pearson Education, 2004.
3. Andrew S Tanenbaum, Maartenvan Steen, "Distributed Systems, Principles and Paradigms",Pearson Education, 2002.
4. Mugesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw Hill Edition, 2001.

WEB REFERENCES:

1. https://www.cs.uky.edu/~jzhang/
2. https://moodle.risc.jku.at/course/view.php?id=143

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=dlBVWMdGhqw&list=PLUJ7JmcrTifBROWODSG8wgyl20XgBuE-N
2. https://www.youtube.com/watch?v=qbQCQ0U6H0o&list=PLbMVogVj5nJQRvzENlvMKA9q70ScSRZBQ

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Work on appropriate parallel programming model
2. Model and visualize Design protocols for ensuring cache coherence
3. Students will be familiar with the design Distributed System.
4. To implementation and security issues of distributed system.
5. To implement Transaction Processing of distributed system.

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVES II

20PBDEL304	PREDICTIVE MODELLING	L	T	P	C
SDG NO. 4		3	0	0	3

OBJECTIVES:

- To understand the terms and terminologies of predictive modeling.
- To study the various predictive models, their merits, demerits and application.
- To get exposure to various analytical tools available for predictive modeling.
- To learn the predictive modeling markup language.
- To get familiar with the technologies in predictive modeling.

UNIT I INTRODUCTION TO PREDICTIVE MODELING 9

Core ideas in data mining - Supervised and unsupervised learning Classification vs Prediction - Steps in data mining- SEMMA Approach - Sampling -Pre-processing - Data cleaning - Data Partitioning - Building a model Statistical models - Statistical models for predictive analytics.

UNIT II PREDICTIVE MODELING BASICS 9

Data splitting – Balancing- Over fitting –Oversampling –Multiple Regression Artificial neural networks (MLP) - Variable importance- Profit/loss/prior probabilities - Model specification - Model selection - Multivariate Analysis.

UNIT III PREDICTIVE MODELS 9

Association Rules-Clustering Models –Decision Trees- Ruleset Models-KNearest Neighbors – Naive Bayes - Neural Network Model – Regression Models – Regression Trees – Classification & Regression Trees (CART) –

Logistic Regression – Mulitple Linear Regression Scorecards – Support Vector Machines – Time Series Models - Comparison between models - Lift chart Assessment of a single model.

UNIT IV PREDICTIVE MODELING MARKUP LANGUAGE 9

Introduction to PMML – PMML Converter - PMML Structure – Data Manipulation in PMML – PMML Modeling Techniques - Multiple Model Support – Model Verification.

UNIT V TECHNOLOGIES AND CASE STUDIES 9

Weka – RapidMiner – IBM SPSS Statistics- IBM SPSS Modeler – SAS Enterprise Miner – Apache Mahout – R Programming Language.-Real time case study with modeling and analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kattamuri S. Sarma, "Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications", 2nd Edition, SAS Publishing, 2007.
2. Alex Guazzelli, Wen-Ching Lin, Tridivesh Jena, James Taylor, "PMML in Action Unleashing the Power of Open Standards for Data Mining and Predictive Analytics", 2nd Edition, Create Space Independent Publishing Platform,2012.

REFERENCES:

1. Ian H. Witten, Eibe Frank , "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann, 3rd Edition, 2011.
2. Eric Siegel , "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", 1st Edition, Wiley, 2013
3. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
4. Jeremy Howard, Margit Zwemer, Mike Loukides, "Designing Great Data Products- Inside the Drive train Approach, a Four-Step Process for Building Data Products – Ebook", 1st Edition, O'Reilly Media, March 2012.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108108111/
2. https://www.coursera.org/learn/predictive-modeling-analytics

ONLINE RESOURCES:

1. https://bookdown.org/egarpor/PM-UC3M/
2. https://cics.nd.edu/research/applications/materials/

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Design and analyze appropriate predictive models.
2. Define the predictive models using PMML.
3. Apply statistical tools for analysis.
4. Use various analytical tools available for predictive modeling.
5. Apply predictive modeling markup language in data manipulation.

CO- PO,PSO MAPPING:

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

PROFESSIONAL ELECTIVE - II

20PBDEL305 SDG NO. 4	IMAGE PROCESSING AND ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of digital images and noise models
- To understand spatial domain filters and frequency domain filters
- To understand the image processing techniques
- To familiarize the image processing environment and their applications
- To appreciate the use of image processing in various applications

UNIT I SPATIAL DOMAIN PROCESSING 9

Introduction to image processing – imaging modalities – image file formats – image sensing and acquisition – image sampling and quantization – noise

models – spatial filtering operations – histograms – smoothing filters – sharpening filters – fuzzy techniques for spatial filtering – spatial filters for noise removal

UNIT II FREQUENCY DOMAIN PROCESSING 9

Frequency domain – Review of Fourier Transform (FT), Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) – filtering in frequency domain – image smoothing – image sharpening – selective filtering – frequency domain noise filters wavelets – Haar Transform – multiresolution expansions – wavelet transforms wavelets based image processing

UNIT III SEGMENTATION AND EDGE DETECTION 9

Thresholding techniques – region growing methods – region splitting and merging adaptive thresholding – threshold selection – global valley – histogram concavity edge detection –template matching – gradient operators – circular operators differential edge operators –hysteresis thresholding – Canny operator – Laplacian operator – active contours – object segmentation

UNIT IV INTEREST POINTS, MORPHOLOGY, AND TEXTURE 9

Corner and interest point detection – template matching – second order derivatives median filter based detection – Harris interest point operator – corner orientation local invariant feature detectors and descriptors – morphology – dilation and erosion morphological operators – grayscale morphology – noise and morphology – texture texture analysis – co-occurrence matrices – Laws' texture energy approach – Ade's eigen filter approach

UNIT V COLOR IMAGES AND IMAGE COMPRESSION 9

Color models – pseudo colors – full-color image processing – color transformations smoothing and sharpening of color images – image segmentation based on color noise in color images. Image Compression – redundancy in images – coding redundancy – irrelevant information in images – image compression models – basic compression methods – digital image watermarking.

TOTAL : 45 PERIODS

REFERENCES:

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. W. Burger and M. Burge, "Digital Image Processing: An Algorithmic Introduction using Java", Springer, 2008.

3. John C. Russ, "The Image Processing Handbook", Sixth Edition, CRC Press, 2011.
4. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Third Edition, Pearson,2008.
5. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
6. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
7. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

OUTCOMES:

On completion of this course, the student should be able to

1. Design and implement algorithms for image processing applications that incorporates different concepts of medical Image Processing
2. Explain image modalities, sensing, acquisition, sampling, and quantization, noise models and implement spatial filter operations
3. Familiar with the use of MATLAB and its equivalent open source tools
4. Critically analyze different approaches to image processing applications
5. Explore the possibility of applying Image processing concepts in various applications

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVES III

20PBDEL306 SDG NO. 4&5	DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

UNIT I BASICS OF NEURAL NETWORKS 9

Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

UNIT II INTRODUCTION TO DEEP LEARNING 9

Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.

UNIT III CONVOLUTIONAL NEURAL NETWORKS 9

CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

UNIT IV MORE DEEP LEARNING ARCHITECTURES 9

LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard-Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM

UNIT V APPLICATIONS OF DEEP LEARNING 9

Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

TOTAL: 45 PERIODS

REFERENCES:

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
3. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress , 2017.
4. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
5. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
6. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

WEB RESOURCES:

1. https://nptel.ac.in/courses/106105215/
2. https://nptel.ac.in/courses/106106201/
3. https://www.coursera.org/specializations/deep-learning

ONLINE RESOURCES:

1. https://www.simplilearn.com/deep-learning-tutorial
2. https://www.tutorialspoint.com/machine_learning/deep_machine_learning.htm

OUTCOMES:

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

1. Understand the role of Deep learning in Machine Learning Applications.
2. To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.
3. To design and implement Deep Learning Applications.
4. Critically Analyse Different Deep Learning Models in Image Related Projects.
5. To design and implement Convolutional Neural Networks.

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - III

20PBDEL307 SDG NO. 3,4,13	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Cognitive computing is an effort to develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions
- Cognitive computing presents an appealing new model or paradigm for application development.
- To ingesting data from inside and outside the enterprise, and leveraging functionality to identify and evaluate patterns and complex relationships in large and sometimes unstructured data sets, such as natural language text in journals, books, and social media, or images and sounds.

UNIT I THE FOUNDATION OF COGNITIVE COMPUTING 9

Cognitive Computing as a New Generation-Uses of Cognitive System-Artificial Intelligence as the Foundation-Understanding Cognitive-Two System of Judgement and Choice-Understanding Complex Relationships between System-Element of Cognitive System-Continuous Machine Learning.

UNIT II DESIGN PRINCIPLES 9

Component of Cognitive System-Building the Corpus-Bringing Data into Cognitive System Machine Learning-Hypotheses Generation and Scoring-Presentation and Visualization Services.

UNIT III NATURAL LANGUAGE PROCESSING 9

The Role of NLP-The Importance of Context, Connecting Words for Meaning, Understanding Linguistics, Language Identification and Tokenization,

Phonology, Morphology, Lexical Analysis, Syntax and Syntactic Analysis, Construction Grammars, Discourse Analysis , Semantic Web-Applying Natural Language Technologies to Business Problems

UNIT IV BIG DATA AND COGNITIVE COMPUTING 9

Dealing with Human-Generated Data-Defining Big Data-Architecture Foundation-Analytical Data Warehouses-Hadoop-Data in Motion and Streaming Data-Integration of Big Data with Traditional Data

UNIT V EMERGING AREAS 9

Characteristics of Ideal Markets for Cognitive System- Vertical Markets and Industries- Retail, Travel, Transportation and Logistics, Telecommunications, Security and Threat Detection.

TOTAL: 45 PERIODS

TEXTBOOK

1. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.

WEB RESOURCES:

1. IBM Redguide publication: The Era of cognitive systems: An inside look at IBM Watson and how it works
2. IBM Redbooks publication: IBM Watson content analytics: Discovering actionable insight from your content
3. https://cognitivecomputingconsortium.com/
4. Watson Developer Cloud – website with documentation, demo and technical web series and more
5. Watson Services on Bluemix – website to explore how to build cognitive apps on Bluemix
6. Watson Internet of Things – comprehensive website filled with Watson IoT information
7. Cognitive Computing, technical resources on developerWorks
8. Watson events calendar
9. Bluemixmeetups: Worldwide locations, Additional meetups, events, and webcasts
10. IBM Watson University Program – explore case studies, competitions and more

ONLINE RESOURCES:

1. https://www.endava.com/en/blog/Engineering/2019/Cognitive-Computing-Using-Cloud-Based-Resources

2. https://courses.cognitiveclass.ai/register
3. https://www.youtube.com/watch?v=Pwm6DqdC4pU
4. https://www.youtube.com/watch?v=Pwm6DqdC4pU&list=RDCMUCEBb1b_L6zDS3xTUrIALZOw&start_radio=1&t=55

OUTCOMES

Upon completion of the course, the student should be able to:

1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and discuss the business implications of cognitive computing.
5. Identify and evaluate patterns and complex relationships in large and sometimes unstructured data sets.

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - II

20PBDEL308 SDG NO. 4	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

UNIT I INTRODUCTION **9**

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

UNIT II MODELING AND VISUALIZATION **9**

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

UNIT III MINING COMMUNITIES **9**

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

UNIT IV EVOLUTION **9**

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

UNIT V APPLICATIONS **9**

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

WEB REFERENCES:

1. https://www.datacamp.com/community/tutorials/social-network-analysis
2. https://rpubs.com/wctucker
3. https://mjdenny.com

ONLINE RESOURCES:

1. https://www.datacamp.com/community/tutorials/social-network-analysis-python
2. https://www.slideshare.net/gcheliotis/social-network-analysis-3273045

OUTCOMES

Upon completion of the course, the student should be able to:

1. Work on the internals components of the social network
2. Model and visualize the social network
3. Mine the behaviour of the users in the social network
4. Predict the possible next outcome of the social network
5. Apply social network in real time applications

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - III

20PBDEL309 SDG NO. 4,8,9	VIRTUALIZATION TECHNIQUES AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and deploy practical virtualization solutions and enterprise solutions.
- Able to understand Server Virtualization and Virtualization Platform.
- Understand the technologies of Virtualization and Network Virtualization.
- To understand the concepts of Virtualization storage.
- To study the virtual machine products.

UNIT I OVERVIEW OF VIRTUALIZATION 9

System architectures - Virtual Machine basics - Process vs System Virtual Machines - Taxonomy. Emulation: Basic Interpretation - Threaded Interpretation - Precoded and Direct Threaded Interpretation - Binary Translation. System Virtual Machines - Key concepts - Resource utilization basics.

UNIT II PROCESS VIRTUAL MACHINES 9

Implementation – Compatibility – Levels – Framework – State Mapping – Register – Memory Address Space – Memory Architecture Emulation – Memory Protection – Instruction Emulation – Performance Tradeoff - Staged Emulation – Exception Emulation – Exception Detection – Interrupt Handling – Operating Systems Emulation – Same OS Emulation – Different OS Emulation – System Environment .

UNIT III HIGH LEVEL LANGUAGE VIRTUAL MACHINES AND SERVER VIRTUALIZATION 9

HLL virtual machines: Pascal P-Code – Object Oriented HLLVMs - Java VM architecture - Java Native Interface - Common Language Infrastructure. Server virtualization: Partitioning techniques - virtual hardware - uses of virtual servers - server virtualization platforms.

UNIT IV NETWORK AND STORAGE VIRTUALIZATION 9

Design of Scalable Enterprise Networks – Layer2 Virtualization – VLAN - VFI - Layer 3 Virtualization – VRF - Virtual Firewall Contexts - Network Device Virtualization - Data- Path Virtualization - Routing Protocols. Hardware Devices – SAN backup and recovery techniques – RAID – Classical Storage Model – SNIA Shared Storage Model – Virtual Storage: File System Level and Block Level.

UNIT V APPLYING VIRTUALIZATION 9

Practical Virtualization Solutions: Comparison of Virtualization Technologies: Guest OS/ Host OS – Hypervisor – Emulation – Kernel Level – Shared Kernel, Enterprise Solutions: VMWare Server – VMWare ESXi – Citrix Xen Server – Microsoft Virtual PC – Microsoft Hyper-V – Virtual Box, Server Virtualization: Configuring Servers with Virtualization – Adjusting and Tuning Virtual servers – VM Backup – VM Migration, Desktop Virtualization: Terminal services – Hosted Desktop – Web-based Solutions – Localized Virtual Desktops, Network and Storage Virtualization: Virtual Private Networks – Virtual LAN – SAN and VSAN – NAS.

TOTAL : 45 PERIODS

TEXTBOOK:

1. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.

REFERENCES:

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

5. Kenneth Hess , Amy Newman, "Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, 2010

WEB REFERENCES:

1. lecturer.eepis-its.edu/ ~isbat/materikuliah/ .../ Virtualization. ppt
2. cs.nju.edu.cn/distribute-systems/lecture-notes/c11.ppt
3. https://edux.fit.cvut.cz/oppa/MI-POA/prednasky/MI-POA10.pdf
4. www.cs.otago.ac.nz/cosc440/lectures/lecture%2010.ppt

ONLINE RESOURCES:

1. https://www.simplilearn.com/virtualization
2. tutorialspoint.com/virtualization2.0/virtualization2.0_overview.htm

OUTCOMES:

Upon completion of this course, the student should be able to

1. Design and develop applications on virtual machine platforms
2. To understand the concepts of virtualization and virtual machines.
3. To understand the implementation of process and system virtual machines.
4. To explore the aspects of high level language virtual machines.
5. To gain expertise in server, network and storage virtualization.

CO, PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	2	0	0	0	0	0	0	0	0	0	0	1	0
CO2	1	0	0	0	0	0	0	0	0	0	0	0	2	0
CO3	0	2	0	0	0	0	0	0	0	0	0	0	2	0
CO4	0	2	2	0	0	0	0	0	0	0	0	0	2	2
CO5	0	2	0	0	0	0	0	0	0	0	0	0	2	0

PROFESSIONAL ELECTIVE - III

20PBDEL310 SDG NO. 4,8,9	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the basics and computational properties of natural languages
- Understand the statistical and probabilistic approaches to machine translation of natural language
- Understand the syntax, semantics and pragmatics of natural language
- Familiar with discourse, generation, dialogue of natural language
- Apply the NLP techniques to IR applications

UNIT I INTRODUCTION 9

Introduction: Origins and challenges of NLP – Computing with Language: Texts and Words, Texts as Lists of Words, Computing with Language: Simple Statistics, Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II WORD LEVEL ANALYSIS 9

Accessing Text from the Web and from Disk , Strings: Text Processing at the Lowest Level, Text Processing with Unicode , Regular Expressions for Detecting Word Patterns, Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS 9

Analyzing Sentence Structure,Context-Free Grammars, Grammar rules for English, Treebanks, Grammar Development, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV SEMANTICS AND PRAGMATICS 10

Analyzing the Meaning of Sentences : Natural Language Understanding, Propositional Logic, First-Order Logic , Requirements for representation – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word

Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 8

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin,"Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, OReilly Media. , 2009.

REFERENCES:

1. Breck Baldwin, "Language processing with Java and Ling Pipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
3. NitinIndurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. TanveerSiddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

WEB REFERENCES:

1. https://www.cse.iitb.ac.in/~cs626-460-2012/
2. https://www.coursera.org/learn/language-processing
3. https://www.udacity.com/course/natural-language-processing-nanodegree--nd892

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_tutorial.pdf
2. https://web.stanford.edu/~jurafsky/slp3/ed3book.pdf

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Analyze and generate the natural language text and tag a given text with basic Language features
2. Implement a rule based system to tackle morphology/syntax of a language
3. Compare and contrast the use of different statistical approaches for different types of NLP applications.
4. Design a tag set to be used for statistical processing for real-time applications
5. Design an innovative application using NLP components

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - IV

20PBDEL311 SDG NO. 4&9	DATA INTENSIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of the various database systems including databases for Big data.
- To learn about the architecture of data intensive computing.
- To learn about parallel processing for data intensive computing.
- To learn about Security in Data Intensive Computing Systems.
- To learn about the applications that involves Data intensive computing.

UNIT I INTRODUCTION 9

Introduction to Distributed systems – Databases Vs. File Systems - Distributed file systems(HDFS) – Distributed Machine-Learning System - Data Parallelism – Characteristics -Hadoop –Execution Engines -Map Reduce- Distributed Storage System for Structured Data – NoSQL databases - Casandra, Mongo DB-Developing a Distributed Application

UNIT II ARCHITECTURES AND SYSTEMS 9

High performance Network Architectures for Data intensive Computing – Architecting Data Intensive Software systems – ECL/HPCC: A Unified approach to Big Data – Scalable storage for Data Intensive Computing - Computation and Storage of scientific data sets in cloud- Stream Data Model - Architecture for Data Stream Management-Stream Queries –Sampling Data in a Stream Filtering Streams

UNIT III TECHNOLOGIES AND TECHNIQUES 9

Load balancing techniques for Data Intensive computing – Resource Management for Data Intensive Clouds – SALT - Parallel Processing, Multiprocessors and Virtualization in Data intensive Computing - Challenges in Data Intensive Analysis and Visualization - Large-Scale Data Analytics Using Ensemble Clustering - Ensemble Feature Ranking Methods for Data Intensive Computing Application - Record Linkage Methodology and Applications-Semantic Wrapper

UNIT IV SECURITY 9

Security in Data Intensive Computing Systems - Data Security and Privacy in Data-Intensive Supercomputing Clusters - Information Security in Large Scale

Distributed Systems -Privacy and Security Requirements of Data Intensive Applications in Clouds

UNIT V APPLICATIONS AND FUTURE TRENDS 9

Cloud and Grid Computing for Data Intensive Applications -Scientific Applications - Bioinformatics Large Science Discoveries - Climate Change - Environment - Energy - Commercial Applications - Future trends in Data Intensive Computing

TOTAL : 45 PERIODS

REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media. October 2010.
2. Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom., "Database Systems: The Complete Book", Pearson, 2013.
3. Furht, Borko, Escalante, Armando, "Handbook of Data Intensive Computing", Springer 2011.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Data-intensive_computing
2. https://www.computer.org/csdl/magazine/co/2008/04/mco2008040030/13rRUNvgyZ8

ONLINE RESOURCES:

1. https://www.slideshare.net/huda2018/dataintensive-technologies-for-cloudcomputing

OUTCOMES:

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

1. Design applications that involve data intensive computing.
2. Suggest appropriate architecture for data intensive computing systems.
3. Decide on the appropriate techniques of Map Reduce, Mongo DB, for the different Applications.
4. Identify parallel processing techniques for data intensive computing.
5. Decide on the various security techniques that are necessary for data intensive applications.

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - IV

20PBDEL312 SDG NO. 4	R LANGUGUAGE FOR MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Study the major data mining problems as different types of computational tasks (prediction, classification, clustering, etc.) and the algorithms appropriate for addressing these tasks
- Learn how to analyze data through statistical and graphical summarization, supervised and unsupervised learning algorithms
- Systematically evaluate data mining algorithms and understand how to choose algorithms for different analysis tasks

UNIT I INTRODUCTION DATA MINING 9

Introduction, Mining Association Rules in Large Databases, Mining Frequent Patterns - basic concepts - Efficient and scalable frequent item set mining methods, Apriori algorithm, FP-Growth algorithm, Associations - mining various kinds of association rules.

UNIT II PREDICTIVE MODELING AND CLUSTERING 9

Classification and Prediction-Issues Classification by Decision Tree Induction–Bayesian Classification – Other Classification Methods – Prediction–Clusters Analysis – Basics of cluster analysis -Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

UNIT III MINING DATA STREAMS 9

Introduction To Streams Concepts – Stream Data Model and Architecture -

Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications

UNIT IV DATA ANALYTIC METHODS USING R 9

Introduction to R – Analyzing and exploring data with R - Statistics for model building and evaluation. Analytical Approaches, introducing to various Analytical Tools, Installing R, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and Using Objects, Interacting with Users, Handling Data in R Workspace

UNIT V FUNCTIONS AND PACKAGES IN R 9

Executing Scripts, Reading Datasets and Exporting Data from Manipulating and Processing Data in R, Working with Functions and Packages in R, Performing Graphical Analysis in R, Techniques Used for Visual Data Representation, Types of Data Visualization

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Carlo Vercellis, Business Intelligence: Data mining and Optimization for Decision Making, WILEY.
2. Han J., Kamber M. and Pei J, Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Big Data Computing and Communications edited by Yu Wang, Hui Xiong, ShlomoArgamon, XiangYang Li, JianZhong Li Springer

REFERENCES:

1. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
2. Adriaans P., Zantinge D., Data mining, Pearsoneducation press (1996), 1st ed.

WEB REFERENCES:

1. https://onlinecourses-archive.nptel.ac.in/noc18-mg11/announcements
2. https://swayam.gov.in/nd1_noc19_ma33/preview
3. www.datacamp.com/R-Tutorial

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=BB2O4VCu5j8
2. https://www.tutorialspoint.com/r/index.htm
3. http://www.rdatamining.com/

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Demonstrate accurate and efficient use of classification using the R system for the computations.
2. Demonstrate the related data mining techniques Using R
3. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from the theory that underpins classification and related data mining methods
4. Apply problem-solving using classification and related data mining techniques to diverse situations in business, biology, engineering and other sciences
5. Analyze the data visualization

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - IV

20PBDEL313 SDG NO. 9	WEB ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop customer-centric approach in dealing with data.
- To know the principles, tools and methods of web intelligence.
- To apply analytics for business situations.

UNIT I INTRODUCTION **9**

Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Clickstream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing – Outcomes data – Competitive data – Search Engine Data.

UNIT II STRATEGIES FOR ANALYTICS 9

Qualitative Analysis – Customer Centricity – Site Visits – Surveys – Questionnaires – Website Surveys – Post visits – Creating and Running-Benefits of surveys – Critical components of successful strategy.

UNIT III CONCEPTS OF WEB ANALYTICS 9

Web Analytic concepts – URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports (top pages, top destinations, site overlay). – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0 Analytics – Segmentation – Connectable reports.

UNIT IV GOOGLE ANALYTICS 9

Analytics - Cookies - Accounts vs Property - Tracking Code - Tracking Unique Visitors - Demographics - Page Views & Bounce Rate Acquisitions - Custom Reporting.

UNIT V ADVERTISING AND PROMOTION 9

Goals & Funnels – Filters - Ecommerce Tracking - Real Time Reports - Customer Data Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation - Campaign Tracking - Multi-Channel Attribution.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science Of Customer Centricity ", 1st edition, Sybex, 2009.

REFERENCES:

1. Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users", Morgan Kaufmann, 2013.
2. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., "Game Analytics: Maximizing the Value of Player Data", Springer, 2013.
3. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2nd Edition, Springer, 2011.
4. Justin Cutroni, "Google Analytics", O'Reilly, 2010.
5. Eric Fettman, Shiraz Asif, Feras Alhlou , "Google Analytics Breakthrough", John Wiley & sons, 2016.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Know the concepts and terminologies related to web analytics.
2. Explore various parameters used for web analytics and their impact.
3. Explore the use of tools and techniques of web analytics.
4. Get experience on websites, web data insights and conversions
5. Analyze applications of IoT in real time scenario

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - IV

20PBDEL314 SDG NO. 4, 9 &15	BIO INFORMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Exposed to the need for Bio informatics technologies
- Be familiar with the modeling techniques
- Learn micro array analysis
- Exposed to Pattern Matching and Visualization

UNIT I INTRODUCTION **9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.

UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS **9**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

UNIT III MODELING FOR BIOINFORMATICS 9

Hidden Markov modeling for biological data analysis – Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

UNIT IV PATTERN MATCHING AND VISUALIZATION 9

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT V MICROARRAY ANALYSIS 9

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Yi-Ping Phoebe Chen (Ed), "Bio Informatics Technologies", First Indian Reprint, Springer Verlag, 2007.

REFERENCES:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

WEB REFERENCES:

1. Academic Earth
2. Future Learn
3. Udacity & Alison (Commercial)
4. MIT Open Courseware
5. Peer-2-Peer University
6. Massive Open Online Course (MOOC)
7. Online Courses.com

8. Canvas Network
9. Khan Academy
10. Open SAP

ONLINE RESOURCES:

1. https://www.classcentral.com/subjects/bioinformatics
2. https://mooc-list.com/tags/bioinformatis?_cf_chi_jschi_tk
3. http://www.udemy.com/topic/bioinformatics/?utm_source=adwords

OUTCOMES:

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

1. Develop models for biological data.
2. Apply pattern matching techniques to bioinformatics data – protein data genomic data.
3. Apply micro array technology for genomic expression study.
4. To design and implement bio-informatics algorithms.
5. To characterize and manage the types of biological data analysis.

CO, PO & PSO MAPPING:

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

PROFESSIONAL ELECTIVE - IV

20PXXELXXX SDG NO. 4	STATISTICS FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering Problems.
- To introduce the basic concepts of Time Series and Estimations.
- To acquaint the knowledge of Statistical Inference and Decision Theory.
- The syllabus is designed to provide the basic tools of Statistics for data analysis and Decision making on the sampling and inference.

UNIT I INTRODUCTION TO TIME SERIES 9

Time Series: Meaning And Need Of Time Series Analysis, Components Of Time Series, Additive And multiplicative Model, Utility Of Time Series. Methods Of Determining Trends. Components Of Timeseries, Smoothing Auto Correlation, Stationarity, Concepts Of AR, MA, ARMA & ARIMA Models with Illustrations.

UNIT II ESTIMATION 9

Methods of estimation: Random samples, sampling distributions of estimators, Methods of moments, Unbiasedness: Unbiased estimator, Illustration of unbiased estimator for the parameter and parametric function. Definitions of Consistency, Sufficient condition for consistency, concept of efficiency and sufficiency. Neyman- Factorization theorem (without proof), concept of likelihood function, Maximum Likelihood, Properties of MLE (without proof), Estimation of the parameters of normal distribution and other standard distributions by MLE.

UNIT III STATISTICAL INFERENCE AND DECISION THEORY 9

Statement and proof of Cramer Rao inequality. Definition of Minimum Variance Bound Unbiased Estimator (MVBUE) of $\varphi(\theta)$, (statement only). Rao-Blackwell theorem, Lehmann-Scheffe theorem. Definition of MVUE, Procedure to obtain MVUE (statement only), examples. Minimum Variance Unbiased Estimator (MVUE) and Uniformly Minimum Variance Unbiased Estimator(UMVUE). Basic elements of Statistical Decision Problem. Expected loss, decision rules(nonrandomized and randomized), decision principles (conditional Bayes, frequentist), inference as decision problem, optimal decision rules. Bayes and minimax decision rule. Admissibility ofminimax rules and Bayes rules.

UNIT IV REGRESSION AND RELIABILITY 9

Multiple linear regression, forward, backward & stepwise regression, Logistic Regression. Reliability of system of independent components, association of random variables, bounds on system reliability, improved bounds on system reliability using modular decompositions. Replacement policy comparisons, preservation of life distribution classes under reliability operations. Reversed hazard rate, cumulative reversed hazard function, relation between hazard function and reversed hazard function. Reversed lack of memory property.

UNIT V STATISTICAL QUALITY CONTROL 9

Meaning and purpose of Statistical quality control, Concept of process control, product control, assignable causes, chance causes and rational subgroups. Control charts and their uses, Choice of subgroup sizes, Construction of control chart for (mean), R (range), s (standard deviation), c (no.of defectives),

p (fraction defectives) with unequal subgroup size. Interpretation of non-random patterns of points. Modified control chart. CUSUM Chart. Consumer's risk, producer's risk, OCcurve, acceptance sampling plan by attributes and variables. Concept of Six Sigma.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Barlow, R. E. and Proschan F. (1996). Mathematical Theory of Reliability. John Wiley.
3. Statistical Inference: P. J. Bickel and K. A. Docksum, 2ndEdition, Prentice Hall
4. Duncan A.J. (1974): Quality Control and Industrial Statistics, IV Edition, Taraporewala and Sons.
5. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.

REFERENCES:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences||, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Introduction to Linear Regression Analysis: Douglas C. Montgomery
3. Chatfield C.: The Analysis of Time Series, IInd Edition Chapman and Hall.
4. George Casella, Roger L. Berger (2002), Statistical Inference, 2nd ed., Thomson Learning.
5. Mukhopadhay, Parimal: Theory and Methods of Survey Sampling, Prentice Hall
6. Tobias, P. A. and Trindane, D. C. (1995). Applied Reliability, Second edition, CRC Press.
7. Rao, C.R. Linear Statistical Inference and its Applications, Wiley Eastern.
8. Berger, J.O.: Statistical Decision Theory and Bayesian Analysis, 2nd Edition. Springer Verlag

OUTCOMES:

On completion of this course, the student should be able to

1. Use time Series application in the data analyst.
2. Apply the concept of Point estimation by Method of moments and Maximum likelihood estimation.
3. Evaluate the regression and reliability for the statistical sampling data.
4. apply various estimators for the statistical concepts.
5. Apply various techniques in quality control and acceptance sampling.

CO, PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PS10
CO1	3	1	2	-	-	-	-	-	1	-
CO2	3	2	2	-	-	-	-	-	1	1
CO3	3	2	2	-	1	-	-	-	2	-
CO4	3	2	2	1	1	-	-		1	1
CO5	3	2	2	-	-	-	-	-	2	-

AUDIT COURSES (AC)

20PBDMC102 SDG NO. 4	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

OUTCOMES

On completion of this course, the student should be able to

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Understand the skills needed when writing the Conclusion
5. Ensure the good quality of paper at very first-time submission

AUDIT COURSES (AC)

20PBDMC103 SDG NO. 4	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power. Extract huge knowledge from ancient literature.

UNIT I ALPHABETS **6**

Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES **6**

Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS **6**

Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE **6**

Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

REFERENCES

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

OUTCOMES:

On completion of this course, the student should be able to

1. Understanding basic Sanskrit language.
2. Write sentences.
3. Know the order and roots of Sanskrit.
4. Know about technical information about Sanskrit literature.
5. Understand the technical concepts of Engineering.

AUDIT COURSES (AC)

20PBDMC104 SDG NO. 4	VALUE EDUCATION	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Students will be able to Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I

Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements

UNIT II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT III

Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV

Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to Knowledge of self-development.

1. Learn the importance of Human values.
2. Developing the overall personality.

SUGGESTED READING

1. Chakroborty, S.K."Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

AUDIT COURSES (AC)

20PBDMC105 SDG NO. 4	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY 6

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 6

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 6

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 6

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 6

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

SUGGESTED READING

1. Ackers J, HardmanF (2001) Classroom interaction in Kenyan primary schools, Compare, 31(2): 245-261.
2. Agrawal M (2004)Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36(3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1.London:DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33(3): 272–282.
5. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M(2003) Read India: Amass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

OUTCOMES:

Students will be able to understand:

1. What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT COURSES (AC)

20PBDMC201 SDG NO. 4	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION **6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS **6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA **6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

OUTCOMES:

1. Ability to summarize basics of disaster
2. Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3. Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4. Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Ability to develop the strengths and weaknesses of disaster management approaches

AUDIT COURSES (AC)

20PBDMC202 SDG NO. 4	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional

- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION 5

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION 5

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES 5

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE 5

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION 5

District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION 5

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

3. M.P. Jain, Indian Constitution Law, 7 th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

OUTCOMES

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization
3. of social reforms leading to revolution in India.
4. Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
5. Discuss the passage of the Hindu Code Bill of 1956.

AUDIT COURSES (AC)

20PBDMC203 SDG NO. 4	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

OBJECTIVES:

- To achieve overall health of body and mind
- To overcome stress

UNIT I

Definitions of Eight parts of yoga.(Ashtanga)

UNIT II

Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III

Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 30 PERIODS

SUGGESTED READING

1. 'Yogic Asanas for Group Tarining-Part-I":Janardan Swami Yoga bhyasi Mandal, Nagpur

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

OUTCOMES

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

AUDIT COURSES (AC)

20PBDMC204 SDG NO. 4	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

OBJECTIVES:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I

Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses71,73,75,78 (do's)

UNIT II

Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2- Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

SUGGESTED READING

1. Gopinath, Rashtriya Sanskrit SansthanamP, Bhartrihari's Three Satakam, Niti- sringarvairagya, New Delhi,2010
2. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.

OUTCOMES

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neet is hatakam will help in developing versatile personality of students.

4. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari's Three Satakam, Niti- sringarvairagya, New Delhi,2010
5. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.

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Together let's build a better world where there is NO POVERTY and ZERO HUNGER.

We have GOOD HEALTH AND WELL BEING QUALITY EDUCATION and full GENDER EQUALITY everywhere.

There is CLEAN WATER AND SANITATION for everyone. AFFORDABLE AND CLEAN ENERGY

which will help to create DECENT WORK AND ECONOMIC GROWTH. Our prosperity shall be fuelled

by investments in INDUSTRY, INNOVATION AND INFRASTRUCTURE that will help us to

REDUCE INEQUALITIES by all means. We will live in SUSTAINABLE CITIES AND COMMUNITIES.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing LIFE BELOW WATER, rich and diverse LIFE ON LAND.

We will enjoy PEACE AND JUSTICE through STRONG INSTITUTIONS

and will build long term PARTNERSHIPS FOR THE GOALS.

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

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