

DIRA COLLEGE OF ENGINEERING AND MANAGEMENT

Approved By AICTE New Delhi, DTE (MS) and Affiliated to Pune University (Id-No. PU/PN/Engg/282/2007)

M-TECH SYLLABUS

[24PCE101]: Research Methodology

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
TH: - 2 Hours/Week	PR:01	CAE : 15 Marks
		ESE : 50 Marks
		INT : 25
		Total : 100 Marks
Course Prerequisites : Mathematics		

Course Objectives:

- 1. To understand Research and Research Process
- 2. To acquaint students with identifying problems for research and develop research strategies
- 3. To familiarize students with the techniques of data collection, analysis of data and interpretation.
- 4. To understand and apply different techniques for formulating research problem

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- **CO1:** Understand basics of research concepts including objectives, issues and problems.
- CO2: Summarize and compare different types of research.
- **CO3:** Prepare a preliminary research design for projects in their subject matter areas
- **CO4:** Accurately collect, analyze and report data.
- **CO5:** Present complex data or situations clearly and formulate research problem.
- **CO6:** Review and analyze research findings.

Unit No.	Contents	No. of Session		
	Unit 1: Introduction and Basic Research Concepts			
1	Introduction and Basic Research Concepts Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, Issues and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	7		
	Unit 2: Types of Research			
2	Types of Research Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	7		
	Unit 3: Research Design and Sample Design			
3	Research Design and Sample Design Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling, Stages in Sample Design Sampling methods/techniques Sampling Errors	6		



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	Unit4: Research Methodology		
4	Research Methodology Meaning of Research Methodology, Stages in Scientific Research Process: Identification and Selection of Research Problem, Formulation of Research Problem, Review of Literature, Formulation of Hypothesis, Formulation of research Design, Sample Design, Data Collection, Data Analysis, Hypothesis testing and Interpretation of Data, Preparation of Research Report	7	
Unit 5: Formulating Research Problem			
5	Formulating Research Problem Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	6	
Unit 6: Outcome of Research			
6	Outcome of Research Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	6	

Learning Resources: Text

Books:

- 1. Dawson, Catherine, 2002, "Practical Research Methods", New Delhi, UBS Publishers Distributors.
- 2. Kothari, C.R., 1990, "Research Methodology-Methods and Techniques", New Delhi, Wiley Eastern Limited.
- 3. Kumar, Ranjit, 2005, "Research Methodology-A Step-by-Step Guide for Beginners", (2nded), Singapore, Pearson Education

- 1. Best and Kahn, "Research Methodology", PHI Limited.
- 2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. "An introduction to Research Methodology", RBSA Publishers.
- 3. Sinha, S.C. and Dhiman, A.K., 2002. "Research Methodology", Ess Ess Publications. 2 volumes.



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[24PCE102] : ANALYSIS OF ALGORITHM

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 2 Hours/Week	PR : 01`	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Objectives:

- 1. Demonstrate a familiarity with major algorithm design techniques.
- 2. Apply important algorithmic design paradigms and methods of analysis.
- 3. Solve simple to moderately difficult algorithmic problems arising in applications.

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- CO1: Understand and analyze fundamental algorithms that operate on common data structures.
- **CO2:** Apply concepts of searching and sorting & its mathematical problems.
- CO3: Understand the flow networks.
- **CO4:** Understand advanced graph matching algorithms including minimum spanning trees and shortest paths flow networks and linear programming.
- **CO5:** Demonstrate the hardness of simple NP-complete problems.
- **CO6:** Apply searching techniques to solve modern problem .

Unit No.	Contents	No. of Session		
	Unit 1: Unit 1: Sorting			
1	Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis	6		
	Unit 2: Matroids & Graph Matching			
2	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8		
	Unit 3: Flow-Networks & Matrix Computations			
3	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition	8		
	Unit4: Discrete Fourier Transform (DFT) & Representation of integers/polynomials			



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4	 Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. 	8
	Application: Interpolation problem.	
	Unit 5: Linear Programming	
5	Linear Programming: Geometry of the feasibility region and Simplex Algorithm NP- completeness: Examples, proof of NP-hardness and NP-completeness. Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm. Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures	8
	Unit 6: Searching & Sorting Problem Solving	
	Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures, examples with solution.	4

Learning Resources:

Text Books:

- 1. Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
- 2. The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.

Reference Books:

- 1. Algorithm Design" by Kleinberg and Tardos.
- 2. Fundamentals of Algorithmics" by Gilles Brassard and Paul Bratley.

Moocs:

- 1. Analysis of Algorithms | Coursera
- 2. <u>CS 161 Design and Analysis of Algorithms (stanford.edu)</u>



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[24PCE103A]: Elective I - Optimization Techniques

Teaching Scheme:	Credit	Examination Sc	cheme:	
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks	5	
PR: - 4 Hours/Week	PR : 02	CAE : 15 Marl	KS	
		ESE : 50 Mar	ks	
		EXT : 25		
		Total : 100 Mark	KS	
Course Prerequisites : Database Man	nagement system, Design an	d Analysis of Algo	rithms	
 Course Prerequisites : Database Management system , Design and Analysis of Algorithms Course Objective: Introduction to optimization techniques using both linear and non-linear programming. The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization too. After an adequate introduction to linear algebra and probability theory, students will learn to frame engineering minima maxima problems in the framework of optimization problems Course Outcome: After successful completion of the course, students will able to: CO1 : Understand importance of optimization of industrial process management CO2 : Apply basic concepts of mathematics to formulate an optimization problem using Linear programming CO3 : Learn efficient computational procedures to solve optimization problems using Non LinearProgramming CO4 : Formulation simplex methods variable with upper bounds CO5 : Understand the maximization and minimization of convex 				
techniques	twork based optimization			
L	Course Contents			
UNIT-I	Introduction		07 Hours	
Introduction: Engineering application example for minimum weight and opti and techniques, Single variable, multi constraints.	n of optimization, statement mum cost consideration, clas -variable with equality and ir	of an optimization sification of optimi equality constraint	n problem with zation problems s and without	
UNIT-II	Linear Programming		08 Hours	
Introduction, basic terminology Techr simplex method: Dual Simplex Metho	niques of linear programming od, decomposition principle, j	: Simplex method, post-optimality ana	Revised lysis.	
UNIT-III	Non Linear Program	ning	08 Hours	
Introduction, elimination methods: various search methods Fibonacci method and golden section method Interpolation method-Quadratic and cubic interpolation methods, KKT conditions, Direct root method.				
UNIT-IV Unco	onstrained optimization Teo	hniques	07 Hours	
Introduction; Standard form of the pro- method, Random search method, Univ Steepest Descent (Cauchy) method, C engineering problems.	oblem and basic terminology variate and pattern search me onjugate gradient method, N	Direct search meth thod Indirect search ewton's method, A	hod- Simplex h method- pplication to	



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UNIT-V	Constrained Optimization Introduction	08 Hours			
Standard form of the	Standard form of the problem and basic terminology; Direct method: Sequential Linear Programming;				
Generalized Reduced	d gradient method, Methods of feasible direction Indirect	method: Penalty			
functionmethod Inter	ior and exterior penalty function method, Convex programming	g problem, Check			
for convergence App	lication to engineering problems.				
UNIT-VI	Introduction to non-traditional methods	07 Hours			
Genetic Algorithm: In	ntroduction, Representation of design variables, objective funct	ion			
andconstraints, Gener	tic operators and numerical results. Introduction to Neural netw	ork			
based optimization.					

References:

- 1.) S. S. Rao, Engineering Optimisation- Theory and Practice, New Age International.
- 2.) Deb K., Optimisation for Engineering Design-Algorithms and Example, Prentice Hall.
- 3.) U.Kirsch, Optimum structural design, McGrawHill, New York.
- 4.) Gallagher and O.C Zeinkiewicz, Optimum Structural Design Theory & Applications, John Wiley.
- 5.) D. Bertsekas Nonlinear programming, 2nd Edition, Athena Scientific, 1999, Nashua.
- 6.) R. K. Sundaram, A first course in optimization theory, 1996, Cambridge University Press, Cambridge



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[24PCE103B]:	Elective I	- Network	Design	and	analysis
	Liccurvei		2 congin		und <i>y</i> 515

Teaching Scheme	.	Credit	Fyaminatio	n Scheme
TH 4 Hours/W	eek			arks
$\frac{111.}{PR \cdot - 4 Hours/Weak$	ek	PR · 02	CAE · 15 M	arks
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			EXT: 25	
			T-4-1 - 100 M	· I
			10tal : 100 M	агкя
Course Prerequis	sites : Computer Net	work		
Course Objective				
Understand the the	eoretical issues in pro-	otocol design and apply	it to Quality of serv	ice in
networks, issues in	the design of netwo	ork processors and apply	them to design netv	vork systems.
Course Outcome	•			
After successful c	completion of the co	ourse, students will abl	e to:	
CO1 : Simulate we	orking of wired and	wireless networks to un	derstand networking	concept
CO2 : Develop sol	lutions by applying k	knowledge of mathemati	cs, probability, and	statistics to
networkdesi	ign problems.			
CO3 : Understand	the basics of softwa	re defined networking a	nd explore research	problems in
thatarea				
		Course Contents		
UNIT-I Congestion contro FIFO,Fair Queuin Fast Retransmit a	ol and Resource allo g, TCP Congestion (nd Fast Recovery.	Internetworking ocation: Issues of Reso Control: Additive Increa Congestion-Avoidance	urce Allocation, Qu se/Multiplicative De Mechanisms: DEC	08 Hours Leuing Disciplines: ecrease, Slow Start, bit, Random Early
UNIT-I Congestion contro FIFO,Fair Queuin Fast Retransmit a Detection (RED Requirements, Into Services (PSVP)	ol and Resource allo g, TCP Congestion (and Fast Recovery.), Source-Based egrated Differentiated Service	Internetworking ocation: Issues of Reso Control: Additive Increa Congestion-Avoidance Congestion Avoidance	urce Allocation, Qu se/Multiplicative Do Mechanisms: DEC e, Qualityof Ser	08 Hours acuing Disciplines: ecrease, Slow Start, bit, Random Early vice: Application
UNIT-I Congestion contro FIFO,Fair Queuin Fast Retransmit a Detection (RED Requirements, Into Services (RSVP),	bl and Resource allo g, TCP Congestion (and Fast Recovery.), Source-Based egrated Differentiated Servio	Internetworking ocation: Issues of Reso Control: Additive Increa Congestion-Avoidance Congestion Avoidanc ces (EF, AF) Routing	urce Allocation, Qu se/Multiplicative Do Mechanisms: DEC e, Qualityof Ser	08 Hours acting Disciplines: ecrease, Slow Start, bit, Random Early vice: Application 07 Hours
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UNIT-I Congestion contro FIFO,Fair Queuin, Fast Retransmit a Detection (RED Requirements, Into Services (RSVP), UNIT-II IPv4 Routing Prir IPv6, Border Gate UNIT-III IPv4 deficiencies, Neighbour Discov Unit IV Virtualization and Technologies, VPI UNIT-V MAC Protocols fo RoutingProtocols Layer:ATCP. UNIT-VI	ol and Resource allo g, TCP Congestion (und Fast Recovery.), Source-Based egrated Differentiated Service nciples, Routing Info way Protocol (BGP) patching work done ery, Routing, Resour Advance networl Data Center Design N Design Advance Networless N for Ad Hoc Wireless Software D ftware Defined Network	Internetworking Decation: Issues of Reso Control: Additive Increa Congestion-Avoidance Congestion Avoidance Congestion Avoidance ces (EF, AF) Routing ormation Protocol (RIP), b, EIGRP, High Availabi IPv6 with IPv4, IPv6 address rce Reservation, IPv6 pr ks , Wireless LAN Design, M Hoc Wireless Networl Networks: MACA/W,M Networks: DSDV, DSF refined Networking and Design	urce Allocation, Qu se/Multiplicative Do Mechanisms: DEC e, Qualityof Ser IGRP and EIGRP, O lity Routing 	08 Hours acuing Disciplines: acrease, Slow Start, bit, Random Early vice: Application 07 Hours OSPF for IPv4 and 07 Hours cast, ICMPv6, 07 Hours ditional WAN 08 Hours MACA/PR. Transport 07 Hours trollers



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References:

- R1. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Elsevier, Fourth Edition.
- R2. Philip M. Miller, TCP / IP: The Ultimate Protocol Guide Applications, Access and DataSecurity Vol 2, Wiley
- R3. Pete Loshin, IPv6: Theory, Protocols and Practice, Morgan Kaufmann, 2nd Edition, 2004.
- R4. C. Siva Ram Murthy, B.S. Manoj, Ad Hoc Wireless Networks: Architectures and, Prentice Hall, 2004.
- R5. Thomas D NAdeau and Ken Grey, Software Defined Networking, O'Reilly, 2013. William Stallings, High-Speed Networks and Internets, Pearson Education, 2nd Edition, 2002.



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[24PCE103C] : BLOCKCHAIN TECHNOLOGY AND APPLICATIONS

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR : 02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Objectives:

- 1. To learn basic knowledge and understandings of Blockchain
- 2. learn about the mechanisms of Bitcoin, Ethereum and Hyperledger fabric
- 3. To learn privacy and security issues of block chain

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- **CO1:** Use blockchain in application development.
- **CO2:** Understand the Byzantine model of fault tolerance.
- **CO3:** Use blockchain scripting language
- **CO4:** Apply Ethereum and its Smart Contracts in application development.
- **CO5:** Understand hyperledger.
- **CO6:** Analyse privacy and security issues.

Unit No.	Contents	No. of Session			
	Unit 1: Introduction				
1	Introduction Need for Distributed Record Keeping Modeling faults and adversaries Byzantine Generals problem, Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault- tolerant distributed computing, digital cash	6			
Unit 2: Basic Crypto primitives					
2	Basic Crypto primitives Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems	8			
Unit 3: Blockchain1.0					
3	Blockchain1.0 Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language	8			
	Unit4: Blockchain2.0				



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4	Blockchain2.0 Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	6	
	Unit 5: Blockchain3.0		
5	Blockchain3.0 Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	6	
	Unit 6: Privacy, Security issues in Blockchain		
6	Privacy, Security issues in Blockchain Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains, Prevention of attacks.	6	

Learning Resources:

Text Books:

 Blockchain Technology: Cryptocurrency and Applications by S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press, 2019

Reference Books:

1. The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming by Josh Thompson, Create Space Independent Publishing Platform, 2017



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[24PCE103D] : BUSINESS INTELLIGENCE

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR:02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Objectives:

- 1. Describe the concepts and components of Business Intelligence (BI).
- 2. Critically evaluate use of BI for supporting decision making.

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- **CO1:** Understand the concept of Business Intelligence & Decision support system.
- CO2: Apply mathematical models for decision making.
- **CO3:** Perform clustering & Classification
- CO4: Understand the concept of Artificial Intelligence.
- **CO5:** Understand knowledge management.
- CO6: Understand and use OLAP.

Unit No.	Contents	No. of Session
	Unit 1: Introduction to Business Intelligence & Decision Support System	
1	Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system	6
Unit 2: Data mining & Data Preparation		
2	 Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data, Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction 	6
Unit 3: Classification & Clustering		
3	Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines. Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models	6



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	Unit4: Business intelligence applications: Marketing models		
4	Business intelligence applications: Marketing models: Relational marketing, Sales force managementLogistic and production models: Supply chain optimization, Optimization models for logistics planning,Revenue management systems.Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices	6	
	Unit 5: Knowledge Management		
5	Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge	8	
	Management Systems Implementation, Roles of People in Knowledge Management. Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert System		
Unit 6: On-Line Analytical Processing (OLAP)			
6	OLAP, OLTP, Operational Data Stores, Variations in Data and Approach, OLAP Applications and Functionality, Multi-Dimensions, OLAP Architecture, Cubism, Tools, ROLAP, MOLAP, HOLAP	8	

Learning Resources:

- 1. Business Intelligence: Data Mining and Optimization for Decision Making by Carlo Vercellis, Wiley publisher ,
- 2. Decision support and Business Intelligence Systems by Efraim Turban, Ramesh Sharda, Dursun Delen, Pearson publisher
- 3. Fundamental of Business Intelligence by Grossmann W, Rinderle-Ma, Springer



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Semester-II

[24PCE201]: ADVANCE COMPUTER ARCHITECTURE

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
TH: - 2 Hours/Week	PR:01	CAE : 15 Marks
		ESE : 50 Marks
		INT : 25
		Total : 100 Marks
Course Prerequisites : Mathematics		

Course Objectives:

- 1. Learn advanced design principles of modern processors by addressing key issues such as instruction set design, micro-architecture of superscalar processors, its interaction with other hardware components, and constraints to be addressed when going from single-core to multi-core systems.
- 2. Know about techniques to estimate, analyze and enhance performance as well as reduce power dissipation of computing systems.
- 3. Explore emerging computing trends, computing platforms, and design trade-offs Teaching Methodology: .

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- **CO1:** Understand the history, evolution, classifications & current trends of Computer Architecture; Learn to evaluate & compare System's performance using standard benchmarks.
- **CO2:** Understand the basics of advanced microprocessor techniques & the salient features of state-of- the- art processors deployed in current High Performance Computing systems 3. Understand the differences between System Area Networks & Storage Area Networks & learn the current Networking Technologies for implementing them.
- **CO3:** Learn the advanced RAID Levels, compare SAS vs SATA Disks & understand the implementation of a hierarchical Storage System
- **CO4:** Understand the System Software Architecture, various parallel programming models, message passing paradigms & typical HPCC software stack.
- CO5: Understand, through the case studies of a few selected representative systems.
- CO6: Use and understand different preventive measures.

Unit No.	Contents	No. of Session
	Unit 1: System Architecture	
1	History /Evolution, Definition: Hardware /Software Architecture, Flynn's Classification: SISD,SIMD,MISD,MIMD. Physical Models: PVP, MPP, SMP& Cluster of Workstations (COW). Memory Architectures: Shared, Distributed & Hybrid. UMA, NUMA, CC-NUMA.	8



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	Performance Metrics & Benchmarks (Micro/Macro) Architectural Trends based on TOP 500 List of Supercomputers.	
	Unit 2: Advanced Microprocessor Techniques	
2	CISC, RISC, EPIC, Superscalar, Superpipelined Architectures, Superscalar/ Superpipelined, In Order Execution /Out of Order Execution (OOO), ILP, TLP, Power Wall, Moore's Law Redefined, Multicore Technologies, Intel's Tick-Talk Model. Study of State-of-the- ART Processors : Intel / AMD X86-64 Bit Series: Intel Xeon Family (Xeon Haswell&Broadwell Architectures), Intel Xeon Phi Coprocessors (MIC Architecture) Intel/IBM Itanium/Power Series (Power 4 - Power 9). Introduction to Graphics Processing Units (GPU-NVIDIA).	8
	Unit 3: System Interconnects	
3	SAN : System Area Networks, Storage Area Networks including InfiniBand, Gigabit, Ethernet, Scalable Coherent Interface (SCI) Standard.	5
	Unit4: Storage	
4	Internal/External, Disk Storage, Areal Density, Seek Time, Disk Power, Advanced RAID Levels, SATA vs SAS Disks, Network Attached Storage (NAS), Direct Attached Storage (DAS), I/O Performance Benchmarks	5
Unit 5: Software Architecture		
5	Parallel Programming Models: Message Passing, Data Parallel , MPI/PVM .Typical HPCC Software Stack including Cluster Monitoring Tools, Public Domain Software like GANGLIA, CUDA Programming Environment.	8
	Unit 6: Preventive and Mitigation Measures	
6	Preventive and Mitigation Measures Pre-disaster, during disaster and post-disaster measures in some events in general, Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication. Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids	6

Learning Resources:

- 2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, Elsevier Series, 2011, ISBN:978-0-12-374260-5.
- 3. John L. Hennesy and David Patterson, Computer Architecture : A Quantitative Approach, 6th Edition, Elsevier.
- 4. Kai Hwang and ZhiweiXu, Scalable Parallel Computers, McGraw-Hill, 1998.
- 5. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", 2011, ISBN:978-0-13-138768-3



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[24PCE202]: DATA SCIENCE

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
TH: - 2 Hours/Week	PR:01	CAE : 15 Marks
		ESE : 50 Marks
		INT : 25
		Total : 100 Marks
Course Prerequisites : Mathematics		

Course Objectives:

- 1. To understand the foundations of the Data Science process, methods and techniques
- 2. To build descriptive modeling for statistical analysis of data
- 3. To build predictive models to understand future of the data
- 4. To give exposure to tools and techniques used for large scale data
- 5. To develop various applications of Data Science and find ethical issues in it

Course Outcomes:

On successful completion of the course the learner will be able to:

CO1: Understand the fundamentals of data science to enable, reproduce and use scalable data from a variety of sources.

CO2: Apply statistical methods to make sense out of data sets both large and small.

CO3: Apply regression techniques, and machine learning algorithms on data sets

CO4: Analyze large scale data through various visualization tools

CO5: Use various tools and techniques for big data processing.

CO6: Use data science process in real-life applications and identify ethical challenges in it

Unit No.	Contents	No. of Session
	Unit 1: An Introduction to Data Science	
1	An Introduction to Data Science Facets of Data : Structured data, Unstructured data , Natural language, Machine generated data, Graph based or network data, Audio, Image and Video, Streaming data, The Data Science Process: setting the research goal, retrieving data, Data preparation, Data exploration, model building, Presentation and Automation.	6
Unit 2: Descriptive Analysis		
2	Descriptive Analysis Descriptive Statistics: measure of Central Tendency, Measure of Dispersion, Formulae for the Mean and Standard Deviation, Descriptive Modeling: PCA, SVD, ICA, EM algorithm.	7
Unit 3: Predictive Analysis		
3	Predictive Analysis Review of Probability Theory, Gaussian Discriminant analysis : Linear Discriminant Analysis, Predictive Modeling: Predictive modelling process, Supervised and unsupervised learning, parametric and non parametric model, challenges in predictive modeling.	7



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	Unit4: Data Visualization		
4	Data Visualization History of data Visualization, Basic Principles, visualization tools, using Python libraries for data visualization, interactive visualization, visualization techniques for spatial data, geospatial data, time oriented data and multivariate data	7	
Unit 5: Scaling with Big Data			
5	Scaling with Big Data Introduction of big data, characteristics of big data, data in the warehouse and data in Hadoop, Big data Use cases, Hadoop Ecosystem: HDFS and Map-Reduce, NoSQL, Analyzing data with Pig and R.	7	
Unit 6: Data Science Applications and Ethics			
6	Data Science Applications and Ethics Applications: Text Analytics and Recommendation System, Time Series Analysis Ethical Issues : privacy and legal aspect of data	6	

Learning Resources: Text

Books:

- 1. Davy Cielen, Meysman, Mohamed Ali, "Introducing Data Science", Dreamtech Press
- 2. Kevin P. Murphy, "Machine Learning a Probabilistic Perspective", The MIT Press
- 3. EMC2 Education Services,"Data Science and Big Data Analytics", Wiley Publications

- 1. Dean Abbott, "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst", Wiley, 2014
- 2. Noel Cressie, Christopher K. Wikle, "Statistics for Spatio-Temporal Data", Wiley
- 3. Rachel Schutt and Cathy O'Neil, "Doing Data Science", O'Reilly Media
- 4. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media



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[24PCE203A]: ELECTIVE II - BIG DATA ANALYTICS

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR : 02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Prerequisites : Mathematical Foundation of Computer Science, Data preparation and Analysis

Course Objective:

- 1.) To be acquainted with the fundamental concepts of big data and analytics,
- 2.) To describe various tools and practices for working with big data,
- 3.) To explore various big data visualization tools,
- 4.) To be aware of statistical and data analytics methods.

Course Outcome:

After successful completion of the course, students will able to:

CO1 : Explain the fundamental concepts of big data.

- CO2 : Summarize the fundamental concepts of data analytics.
- CO3 : Discuss the working of Hadoop and its ecosystem.
- CO4 : Selecting appropriate data visualization tools for big data visualization.
- CO5 : Apply Advanced Analytics and Statistical Modeling for Big Data.

Course			
	Contents		
UNIT-I	Introduction To Big Data	07 Hours	
Evolution of Big data	- Best Practices for Big data Analytics - Big data characteristic	s – Validating	
-The Promotion of the	e Value of Big Data – Big Data Use Cases- Characteristics of H	Big Data	
Applications – Percep	tion and Quantification of Value -Understanding Big Data Storag	ge – A General	
Overview of High-Per	formance Architecture – HDFS – MapReduce and YARN – Ma	p Reduce	
Programming Model			
UNIT-II	Overview of Data Analytics Lifecycle	08 Hours	
Phases of a typical analytics lifecycle – discovery, data preparation, model planning, model			
building,communicati	ng results and findings, and operationalizing. Data Analytic Life	e Cycle:	
Overview, phase			
1- Discovery, Phase 2-	- Data preparation, Phase 3- Model Planning, Phase 4- Model Bu	ilding, Phase	
5-Communicate Results, Phase 6- Opearationalize			
UNIT-III	Technologies for Handling Big Data	08 Hours	
Big Data is primarily characterized by Hadoop. This module cover topics such as Introduction to			
Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc, Hadoop			
and its ecosystem whi	and its ecosystem which includes HDFS. MapReduce, YARN		



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UNIT-IV	Hadoop Ecosystems	07 Hours	
HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc., framework of MapReduce and uses of mapreduce.			
UNIT-V	Big Data Visualization	07 Hours	
Why Visualize Data?	? Importance of data visualization, Examples of data visualiza	tion, Input for	
Visualization: Data an	nd Tasks, Common Visualization Idioms Bar Chart, Vertical &	Horizontal Pie	
Chart and Coxcomb 1	Plot, Line Chart, Area Char, Encoding Data using Color, Encod	ing Data using	
Size, Stacked & Grouped Bar Chart, Stacked Area Chart & Streamgraph, Line Chart with Multiple			
Lines, Data Reduction : Histograms, Aggregating Data with Group-By, Hexbin MappingCross-			
filtering			
UNIT-VI	Advanced Analytics and Statistical Modeling for Big Data	07 Hours	
Naïve Bayesian Classifier, categorization using K-means clustering and association rules, predictive modeling using decision trees, linear and logistic regression, and time-series analysis, and text analysis.			

Reference books:

- R1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
- R2. Chris Eaton, Dirk deroos et al., "Understanding Big data", McGraw Hill, 2012.
- R3. Visualization Analysis & Design by Tamara Munzner (2014) (Links to an external site.) Linksto an External site. (ISBN 9781466508910)
- R4. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258. R5. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893

R6. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.



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[24PCE203B]: ELECTIVE II - WIRELESS SENSOR NETWORKS

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR:02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Prerequisites : Computer Networks

Course Objective:

- 1.) To make students learn and understand the concept of Architect sensor networks for various application setups.
- 2.) To Explore the design space and conduct trade-off analysisbetween performance and resources.
- 3.) To Devise appropriate data dissemination protocols and model links cost.
- 4.) To Determine suitable medium access protocols and radio hardware.

Course Outcome:

After successful completion of the course, students will able to:

CO1 : Explain the basic concepts of wireless sensor network.

CO2 : Apply the transmission media concept in WSN.

- CO3 : Understand the concept of MAC protocols in wireless sensor network.
- CO4 : Explain Transport layer protocols & middleware applications.
- CO5 : Apply network management system in WSNs.CO6 : Analyze operating system used in WSNs.

	Course		
	Contents		
UNIT-I	Introduction, Overview and Applications of Wireless Sensor	07 Hours	
	Networks		
Introduction,	Basic overview of the Technology, Applications of Wireless Sense	or Networks:	
Introduction,	Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications,		
Examples of C	Category 1 WSN Applications, Another Taxonomy of WSN Technology		
UNIT-II	Basic Wireless Sensor Technology and Systems	07 Hours	
Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends,			
Wireless Transmission Technology and Systems: Introduction, RadioTechnology Primer, Available			
Wireless Tech	nologies.		



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UNIT-III	MAC and Routing Protocols for Wireless Sensor Networks	07 Hours	
Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-			
MACcase Stud	MACcase Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless		
Sensor Networ	rks: Introduction, Background, Data Dissemination and Gathering, Rou	ting	
Challenges and	d		
Design Issues	in WSNs, Routing Strategies in WSNs.		
UNIT-IV	Transport Control and Middleware for Wireless Sensor	08 Hours	
	Networks		
Traditional Tra	ansport Control Protocols, Transport Protocol Design Issues, Examples	of Existing	
Transport Control Protocols, Performance of Transport Control Protocols. Middleware for			
Wireless			
Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture,			
ExistingMiddleware.			
UNIT-V	Network Management Wireless Sensor Networks	08 Hours	
Introduction, N	Network Management Requirements, Traditional Network Management		
Models, Network Management Design Issues.			
UNIT-VI	Operating System for Wireless Sensor Networks	08 Hours	
Introduction, O	Introduction, Operating System Design Issues, Examples of Operating Systems.		

References:

R1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010 2.R2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information ProcessingApproach", Elsevier, 2007.



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[24PCE203C] : ELECTIVE II - INFORMATION RETRIEVAL & WEB MINING

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR : 02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Prerequisites : Database Management System

Course Objective:

1.) To elaborate on the fundamentals of information retrieval (IR),

- 2.) To study of indexing, searching,
- 3.) To study retrieval models, relevance, classification and organization of information
- 4.) To study web data Retrieval and web Information integration using web mining.

Course Outcome:

After successful completion of the course, students will able to:

CO1 : Identify and design the various components of an Information Retrieval system

- CO2 : Apply machine learning techniques to text classification and clustering
- CO3 : Understand how statistical models of text can be used to solve problems in IR
- CO4 : Analyze the Web content structure
- CO5 : Understand techniques of opinion mining and sentiment analysis

CO6 : Design an efficient search engine using mining methodologies

Course Contents			
UNIT-I	JNIT-I Introduction to Information Retrieval		
		Hours	
Basic Concepts, Retrie	Basic Concepts, Retrieval Process, the nature of unstructured and semi-structured text. Inverted index		
and Boolean queries, Retrieval Evaluation – Word Sense Disambiguation Querying: Languages, Key			
Word based Querying	Pattern Matching, Structural Queries, Query Operations		
	Text Indexing Storage and Compression	07	
UNII-II	rext indexing, Storage and Compression	Hours	
Text or as din as talsanis	ation structure store would always index optimization. Index of	nours	
Text encoding: tokenization, stemming, stop words, phrases, index optimization. Index compression:			
lexicon compression and postings, lists compression. Gap encoding, gamma codes, Zipf's Law. Index			
construction. Postings	s size estimation, merge sort, dynamic indexing, positional index	es, n-gram	
indexes, real-world iss	ues.		



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UNIT-III	Retrieval Models	07 Hours	
Boolean, vector space, TFIDF, Okapi, probabilistic, language modeling, latent semantic indexing.			
Vector space scoring.	The cosine measure. Efficiency considerations. Document length		
normalization.Relevan	nce feedback and query expansion. Rocchio.		
UNIT-IV	Web Mining	08 Hours	
Overview the concept	of web mining. Study the challenges of knowledge extraction from	om web scale	
datasets, Mining the w	veb page layout structure, mining web link structure, mining multi	media data on	
the web, Automatic cl	assification of web documents. Hypertext, web crawling, search e	ngines,	
ranking, link analysis,	Page Rank, HITS, XML and Semantic web.		
UNIT-V	Opinion Mining and Sentiment Analysis	08 Hours	
Opinion Mining and	Opinion Mining and Sentiment Analysis: The Problem of Opinion Mining, Document		
SentimentClassification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon			
Expansion, Aspect-Based Opinion Mining, Opinion Search and Retrieval, Opinion Spam			
Detection.			
UNIT-VI	Advanced Topics	08 Hours	
Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information Retrieval			

- R1. David A. Grossman, Ophir Frieder, Information Retrieval Algorithms and Heuristics,
- R2. Wilbert Liu, Bing, "Web Data Mining", 2nd Edition, Elseiver
- R3. R. Baeza-Yates and B. Ribeiro Neto,—Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, Addison Wesley, 2011
- R4. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, Introduction toInformation Retrieval, Cambridge University Press, 2008
- R5. Soumen Chakrabarti, "Mining the Web", Morgan-Kaufmann Publishers, Elseiver.



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[24PCE203D] : ADVANCED DIGITAL FORENSICS

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH: 04	TAE : 10 Marks
PR: - 4 Hours/Week	PR : 02	CAE : 15 Marks
		ESE : 50 Marks
		EXT : 25
		Total : 100 Marks

Course Objectives:

- 1. To focus on the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered, and preparation of expert testimonial evidence.
- 2. To provide hands on experience on various forensic tools and resources for system administrators and information system security officers.

Course Outcomes:

Course Outcomes: On successful completion of the course the learner will be able to:

- CO1: To classify various cybercrimes, its prevention methods and understand the phases of Digital
 - forensic investigation using different forensic tools.
- **CO2:** To develop a strong familiarity with Windows evidence including file systems, operating systems, user, and application artefacts.
- CO3: To perform forensic analysis in Linux/ MAC operating system environments
- **CO4:** To perform forensic analysis of multimedia files.
- **CO5:** To apply the knowledge of IDS to secure network and performing router and network analysis.
- **CO6:** To conduct a digital forensics investigation of mobile devices and perform recovery of digital evidence using variety of software utilities.

Unit No.	Contents	No. of Session	
	Unit 1: Introduction to Digital Forensics		
1	Digital Forensics Introduction, Classification of Digital Crimes. Forensics Investigation Process- Pre- search consideration, Collection of Evidences from crime scene, Acquisition, Duplication & Preservation of evidences, Examination and Analysis of evidences, Storing of Evidences, Documentation and Reporting, Maintaining the Chain of Custody. Hashing and its importance. Understanding Storage Formats for Digital Evidences – Raw Format, Proprietary Formats, Advanced Forensic Formats. Data Acquisition of live system, Shutdown Systems and Remote systems. Digital Forensics Standard Operating Procedures. Software and Hardware Tools used in Forensic Analysis – Open Source and Proprietary tools. Challenges and issues in Cyber-crime investigation and Digital forensics	7	



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Unit 2: Windows Forensics			
2	Windows Forensics Windows Systems Artifacts: File Systems, Registry, Event logs, Shortcut files, Executables. Alternate Data Streams (ADS), Hidden files, Slack Space, Disk Encryption, Windows registry, startup tasks. Forensic Analysis of the Registry – Use of registry viewers, Regedit. Extracting USB related artifacts and examination of protected storages. Email investigations. Data recovery – Tools and techniques. Malware Analysis.	6	
	Unit 3: Linux and MAC Forensics		
3	Linux and MAC Forensics Linux system and Artifacts – Use of built-in command line tools for forensic investigation – dd, dcfldd, fdisk, mkfs, mount, unmount, md5sum, sha1sum, dmseg; Ownership and Permissions, Hidden files, User Accounts and Logs. Mounting of hard disk having forensic image, Use of "FIND" command for searching and timeline analysis of files. Mac OS system and Artifacts - System startup and services, Hidden directories, System Logs and user Artifacts	6	
	Unit4: Image Analysis		
4	Image Analysis Formation of Image, Image Sampling and Quantization, Basics of Full-color Image Processing, Image Enhancement Techniques, Filters for Image Enhancement, JPEG, PNG, Header Data Analysis, Noise Analysis, Linkage of Camera. Image Steganography, Image Forgery Detection, Detect Steganography from Image, Digital Watermark, Forensic Analysis of Multimedia Files. Video Analysis Forensic Video Analysis, Enhancement Techniques, Specific Frame Analysis.	7	
	Unit 5: Network Forensics		
5	Network Forensics Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols -Email Tracing- Internet Fraud.	6	
	Unit 6: Mobile Forensics		
6	Mobile Forensics Advantage and Disadvantages of Mobile Phones and their Forensic Applications. Operating Systems: Introduction, Objective and Types of Operating System- Java, Symbian, Window, Android and iPhone. Evidence Collection from Mobile Phones and SIM Cards. Recovering and Reconstructing of Deleted Data (call records, phone books, massages, multimedia files i.e. image, video etc.) from Mobile Phones and SIM Cards. Process of Cloning of SIM Data and Password Extraction from Mobile Phones	8	

Learning Resources:

Text Books:

- 1. Bill Nelson, Amelia Philips and Christopher Steuart, "Guide to computer forensics investigation", Course technology, 6th edition
- 2. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGrawHill,



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3. John Sammons; "The basics of Digital Forensics: The Primer for getting started in Digital Forensics", Elsevier, Syngress, 2014.

- 1. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 2009.
- 2. Anthony T.S. Ho and Shujun Li, "Handbook of digital forensics of multimedia data and devices" Wiley Publications 2015