GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Engineering
Subject Code: 3722321
Semester II
SUBJECT NAME: Distributed Databases

Type of course: Elective

Prerequisite: Database Management System, Computer Network, Distributed Systems

Rationale: Distributed Systems are gaining popularity due to various advantages it offers. Database is also getting distributed. When database is distributed, the concepts of database need to be revisited, the student should be made aware of the concepts such as architecture, how to distribute database, database control, optimizing query, controlling replication, handling concurrency and deadlock.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No	Content	Total Hrs	% Weightage
1	**Introduction:** Distributed Data Processing, Promises of DDBs, Complicating Factors, and Problem Areas.	2	5%
2	**Distributed DBMS Architecture:** DBMS Standardization, Architectural Models for Distributed DBMS, Distributed DBMS Architecture	2	5%
3	**Distributed Database Design:** Alternative Design Strategies, Distribution Design Issues, Fragmentation, Distribution Transparency, and Allocation.	5	10%
4	**Semantic Data Control:** Authentication and Access Rights, View Management, Data Security, Semantic Integrity Control & its Enforcement	2	4%
5	**Overview of Query Processing:** Query Processing Problem, Objective of Query Processing, Complexity of Relational Algebra Operations, Query Processing in Centralized System, Query Processing in Distributed System, Characterization of Query Processors, Layers of Query Processing.	4	10%

6	**Query Decomposition & Data Localization:** Query Decomposition, Localization of Distributed Data	2	4%
7	**Optimization of Distributed Queries:** Query Optimization, Centralized Query Optimization, Join Ordering in Fragmented Queries, Distributed Query Optimization Algorithms.	5	10%
8	**Introduction to Transaction Management:** Definition of Transaction, Properties of Transactions, Types of Transactions.	2	4%
9	**Distributed Concurrency Control:** Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Lock based Concurrency Control Mechanisms, Time Stamp based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management, Relaxed Concurrency Control	5	10%
10	**Distributed DBMS Reliability:** Reliability Concepts & Measures, Failures & Fault Tolerance in Distributed Systems, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Dealing with Site Failures, Network Partitioning.	5	10%
11	**Parallel Database Systems:** Database Servers, Parallel Architectures, Parallel DBMS Techniques, Parallel Execution Problems, Parallel Execution for Hierarchical Architecture.	5	10%
12	**Implementation:** Overview of Java Messaging Service(JMS), J2EE Support for Distributed Process Platform Requirements, Microsoft .Net Support for Distributed Process Platform Requirements, RMI, CORBA	6	12%
13	**Current Issues:** Data Delivery Alternatives, Push-based Technologies, Mobile Databases, Models and Current Trends in Improving the Performance of Distributed Database.	3	6%

Reference Books:

1. Principles of Distributed Database Systems by M. Tamer Ozsu, Patrick Valduriez, Pearson Publication.
2. Distributed Database Management Systems- A Practical Approach by Saeed K Rahimi, Frank S Haug, Wiley Publication
3. Distributed Databases Principles and Systems by Stefano Ceri, Giuseppe Pelagatti. Mcgraw Hill Publication

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand Distributed database systems (DDBMS), its architecture, design & security issues.	25

CO-2	Apply the concepts of query processing and decomposition to different queries.	20
CO-3	Understand the issues related to DDBMS such as reliability, concurrency control and related algorithms.	25
CO-4	Understand parallel database system and its architecture and latest trends in subject.	15
CO-5	Implement various DDBMS problems using JMS, J2EE, RMI, CORBA	15

Suggested Practical List:
1. Write an application using JAVA/.NET which access two different databases created using same DBMS and implements DDL and DML commands.
2. Write an application using JAVA/.NET which access two different databases created using two different DBMS and implements DDL and DML commands.
3. Write an application using JAVA/.NET which shows implementation of horizontal fragmentation.
4. Write an application using JAVA/.NET which shows implementation of vertical fragmentation.
5. Write an application using JAVA/.NET which shows implementation of hybrid fragmentation.
6. Write an application using JAVA/.NET to demonstrate distributed query processing.
7. Write an application using JAVA/.NET to demonstrate ACID properties implementation of transaction.
8. Write an application using JAVA/.NET to demonstrate concurrency control mechanism.
9. Write an application using JAVA/.NET to demonstrate two phase commit protocol.
10. Write an application using JAVA/.NET to demonstrate three phase commit protocol.
11. Write an application using CORBA to demonstrate distributed database system.
12. Write an application using RMI to demonstrate distributed database system.

Major Equipment: Networked Lab, RDBMS software, Open Source Software

List of Open Source Software/learning website:

http://infolab.stanford.edu/cs347.2001.spring/lectures.html
http://computingnow.computer.org/web/computingnow
http://www.csee.umbc.edu/portal/help/oracle8/server.815/a67784/ds_ch5.htm

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722322
Semester – II
Subject Name: Web Analytics and Development

Type of course: Elective

Prerequisite: ---

Rationale: The course explores use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction** – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization	10	20%
2	**Web Analytics tools:** Click Stream Analysis, A/B testing, Online Surveys	8	17%
3	**Web Search and Retrieval:** Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models	9	19%
4	**Making Connection**: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity	12	25%
5	**Connection:** Connection Search, Collapse, Robustness Social involvements and diffusion of Innovation	9	19%
	Total	48	**100%**

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722322

Reference Books:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

Course Outcomes:

At the end of the module the student will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Become familiar with core research communities, publications, focused on web and social media analytics and research questions engaged in.	30%
CO-2	Get insight of different data models and methods for web analysis and their application to develop new ones.	30%
CO-3	Practical accountability of different tools available in the market for network analysis to find the impact and connectivity in the real world.	40%

List of Experiments:

1. To perform data collection from any social media network.
2. To perform analysis on the data collected from the social network with key parameters details.
3. To perform web traffic and click analysis using any open web analytics tool.
4. To study search engine optimization algorithm.
5. To perform page ranking algorithm.
6. To study details about Google Analytics.

Major Equipment: --

List of Open Source Software/learning website: Google Analytics, Twitter Analytics, Bitly, Piwik, Clicky, Python

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722323
Semester – II
Subject Name: Information Theory and Coding

Type of course: Elective

Prerequisite: Probability Theory, Computer Networks

Rationale: The objective of this course is to provide an insight to information coding techniques, error correction mechanism. Various compression techniques for text, video and image are covered for thorough knowledge of efficient information conveying systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW)	8	17%
2	Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes	9	19%
3	Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques	8	17%
4	Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-D Compression, CCITT group 3 2D compression, CCITT group 4 2-D Compression.	10	20%
5	Convolutional codes, sequential decoding. Video image Compression: CITT H261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.	9	19%
6	Case study of CCITT group 3 1-DCompression, CCITT group 3 2D compression.	4	8%
	Total	**48**	**100%**

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722323

Reference Books:

1. Fundamentals in information theory and coding, Monica Borda, Springer.
2. Communication Systems: Analog and digital, Singh and Sapre, TataMcGraw Hill.
3. Multimedia Communications Fred Halsall.
4. Information Theory, Coding and Cryptography R Bose.
5. Multimedia system Design Prabhat K Andleigh and Kiran Thakrar.

Course Outcomes:

At the end of the module the student will be able to:

Sr. No.	CO statement	Marks % Weightage
CO-1	Introduce the principles and applications of information theory.	15%
CO-2	Study how information is measured in terms of probability and entropy.	20%
CO-3	Learn coding schemes, including error correcting codes, The Fourier perspective; and extensions to wavelets, complexity, compression, and efficient coding of audio-visual information.	40%
CO-4	Apply linear block codes for error detection and correction.	10%
CO-5	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.	15%

List of Experiments:

1. To perform entropy on the input given as a paragraph.
2. To perform joint entropy and mutual entropy of the given information.
3. To implement error detection technique.
4. To implement error correcting code technique which uses Shannon's Theorem.
5. To implement Lossless compression method
6. To implement Lossy compression method
7. To perform Huffman code on the given input code.
8. To implement LZW algorithm.
9. Case Study on video image and audio compression.

Major Equipment: ---

List of Open Source Software/learning website: C, C++, Python

https://nptel.ac.in/courses/117108097/Learning%20Material%20-%20ITC.pdf

GUJARAT TECHNOLOGICAL UNIVERSITY

English for Research Paper Writing
SUBJECT CODE: 3700001
SEMESTER: I/II

Type of course: Audit course

Prerequisite: -

Rationale: -

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Content

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4	17
2.	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4	17
3.	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	4	17
4.	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	4	17
5.	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	4	16
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4	16

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Outcome:

At the end of the course, the student will 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. Ensure the good quality of paper at very first-time submission

GUJARAT TECHNOLOGICAL UNIVERSITY

Constitution of India
SUBJECT CODE: 3700005
SEMESTER: I/II

Type of course: Audit course

Prerequisite: -

Rationale: -

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Content

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	**History of Making of the Indian Constitution** History Drafting Committee, (Composition & Working)	4	17
2.	**Philosophy of the Indian Constitution:** Preamble Salient Features	4	17
3.	☐ **Contours of Constitutional Rights & Duties:** ☐ 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.	4	17
4.	☐ **Organs of Governance:** ☐ Parliament ☐ Composition ☐ Qualifications and Disqualifications ☐ Powers and Functions ☐ Executive ☐ President ☐ Governor ☐ Council of Ministers ☐ Judiciary, Appointment and Transfer of Judges, Qualifications ☐ ☐ Powers and Functions	4	17

| 5. | ☐ **Local Administration:**
☐ District's Administration head: Role and Importance,
☐ Municipalities: Introduction, Mayor and role of Elected Representative,
☐ CEO of Municipal Corporation.
☐ Pachayati raj: Introduction, PRI: ZilaPachayat.
☐ Elected officials and their roles, CEO ZilaPachayat: Position and role.
☐ Block level: Organizational Hierarchy (Different departments),
☐ Village level: Role of Elected and Appointed officials,
☐ ☐ Importance of grass root democracy | 4 | 16 |
| 6 | ☐ **Election Commission:**
☐ Election Commission: Role and Functioning.
☐ Chief Election Commissioner and Election Commissioners.
☐ State Election Commission: Role and Functioning.
☐ ☐ Institute and Bodies for the welfare of SC/ST/OBC and women. | 4 | 16 |

Reference Books:

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, 7th Edn., Lexis Nexis, 2014.

Course Outcome:

At the end of the course, the student will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
2. 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 of nationhood in the early years of Indian nationalism
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Type of course: Core

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	2	0	0	0	100	100

Content:

A mini project requires comparatively less time than major projects. They are comparatively simpler and have shorter duration. Mini Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Mini Project can help them to boost their skills and widen their horizon of thinking. It will act like a beginners guide to undertake the major project/dissertation during the final year and will ensure preparedness of students to undertake major projects/dissertation. Students will be required to select the topic relevant to their specialization and that has value addition. Students will get an opportunity to work in actual industrial environment if they opt for internship. Based on the selected topic student will also prepare seminar report based on the literature survey

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Course Outcomes: At the end of the course, the student will be able to:
1. Identify engineering problems reviewing available literature.
2. Study different techniques used to analyze complex systems.
3. Solve a live problem using software/analytical/computational tools and present solution by using his/her technique applying engineering principles.
4. Learn to write technical reports and develop skills to present and defend their work in front of technically qualified audience.

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720216
Semester – II
Subject Name: Advance Algorithms

Type of course: Regular

Prerequisite: UG level course in Algorithm Design and Analysis

Rationale: This course will cover fundamental algorithms that operate on common data structures, for instance sorting and searching; advanced design and analysis techniques; advanced graph matching algorithms including minimum spanning trees and shortest paths; flow networks; and linear programming. In summary, this course will provide exposure to recent trends in problem solving paradigms.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Sorting:** Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra'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
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
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.	9
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. Application: Interpolation problem.	10

	Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm		
5	**Linear Programming:** Geometry of the feasibility region and Simplex Algorithm **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. **One or more of the following topics based on time and interest** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm		**10**
6	Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.		**5**

Reference Books:

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

4. "Fundamentals of Algorithmics" by Gilles Brassard and Paul Bratley.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Analyze the time complexity/performance of different algorithms.	**20%**
CO-2	Determining the appropriate data structure for solving a particular set of problem.	**20%**
CO-3	Categorize the different problems in various classes according to their complexity.	**30%**
CO-4	Insight of recent activities in the field of the advanced data structure.	**30%**

List of Experiments:

- Minimum 10 experiments based on the above contents.
- Mini Project in a group of max. 3 students
- Writing a research paper on selected topic from content with latest research issues in that topic

Major Equipments:

- Latest PCs with related software

List of Open Source Software/learning website:

- https://www.coursera.org/specializations/algorithms
- https://visualgo.net/bn
- https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms

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GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Engineering
Subject Code: 3720217
Semester – II
Subject Name: Soft Computing

Type of course: Core Course

Prerequisite: Basic Knowledge of Mathematics

Rationale: To introduce the soft computing concepts and techniques and to foster their abilities in designing appropriate technique for a given scenario. To implement soft computing based solutions for real world problems. T give students knowledge about non-traditional techniques and fundamentals of artificial neural networks, fuzzy logic and genetic algorithms. To provide students hands-on experience on MATLAB to implement various strategies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Unit 1 : INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics	7	14
2	**Unit 2: FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	9	20
3	**Unit 3: NEURAL NETWORKS:** 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	10	20
4	**Unit 4: GENETIC ALGORITHMS:** Goals of optimization, comparison with traditional methods, schemata, Terminology in GA – strings, structure, parameter string, data structures, operators, coding fitness function, algorithm, applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.	9	20
5	**Unit 5: Matlab/Python Lib:** Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic	10	20
6	**Unit 6 :** Recent Trends in various classifiers, neural networks and genetic algorithm	3	06

Reference Books:

1. Jyh Shing Roger Jang, Chuen Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
3. MATLAB Toolkit Manual
4. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill
5. Goldberg, D. E, Genetic algorithm in search, optimization and machine learning, Addison-Wesley, Reading Mass
6. S.N.Sivanandam, S.N.Deepa , Principles of Soft Computing, 2e, Wiley India Pvt. Ltd.
7. S. RAJASEKARAN, G. A. VIJAYALAKSHMI PAI, NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND APPLICATIONS, PHI Learning Pvt. Ltd

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and describe soft computing techniques and their roles in building intelligent machines.	20
CO-2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	20
CO-3	Apply genetic algorithms to combinatorial optimization problems.	20
CO-4	Evaluate and compare solutions by various soft computing approaches for a given problem.	20
CO-4	Use various tools to solve soft computing problems.	20

Suggested List of Experiments: If MATLAB is not available, the practical may be carried out in SCILAB or C/C++/Java

1. Introduction to MATLAB & its environment.
2. Introduction to MATLAB: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos
3. Introduction to MATLAB: Neural Network (NN) Toolbox, NN Simulink Demos
4. MATLAB simulation: Artificial Neural Network (ANN) implementation
5. MATLAB simulation: NN Tool Artificial Neural Network (ANN) implementation
6. MATLAB simulation: Various structure of NN algorithms implementation
7. MATLAB simulation: Training Algorithms of ANN.
8. MATLAB simulation: Coding and minimizing a fitness function using GA.

List of Open Source Software/learning website:

1. http://www.iitk.ac.in/kangal/codes.shtml
2. http://lancet.mit.edu/ga/dist/galibdoc.pdf
3. https://books.google.co.in/books?hl=en&lr=&id=W5SAhUqBVYoC&oi=fnd&pg=PR11&dq=SOft+computing+course+&ots=et_2Nvjy_4&sig=jDXLrGIeD3zc4QUxvcEvC5FrFY#v=onepage&q=SOft%20computing%20course&f=false

Major Equipments / Software:

Students may implement open ended problems on some Microprocessors / DSP boards. Computers with MATLAB / Scilab/ C/C++/Java software may serve the purpose.

GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Engineering
Subject Code: 3722313
Semester – II
Subject Name: Digital Forensics

Type of course: Elective

Prerequisite: Cybercrime and Information warfare, Computer Networks

Rationale:
- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Digital Forensics Science:** Forensics science, computer forensics, and digital forensics. **Computer Crime:** Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics	8	16%
2	**Cyber Crime Scene Analysis:** Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.	7	14%
3	**Evidence Management & Presentation:** Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.	8	18%
4	**Computer Forensics:** Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, **Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.	12	24%
5	**Mobile Forensics:** mobile forensics techniques, mobile forensics tools. **Legal Aspects of Digital Forensics:** IT Act 2000, amendment of IT Act 2008.	8	18%

6	Recent trends in mobile forensic technique and methods to search and seizure electronic evidence	**5**	10%
	Total	**48**	100%

Reference Books:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. Dr. Nilakshi Jain and Dr. Dhananjay Kalbande, Digital Forensic, Wiley Press John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand relevant legislation and codes of ethics	25
CO-2	Computer forensics and digital detective and various processes, policies and procedures	30
CO-3	E-discovery, guidelines and standards, E-evidence, tools and environment	25
CO-4	Email and web forensics and network forensics	20

List of Experiments:

1. To study detail working of boot process the operating system (Windows, Linux).
2. To study a case for digital evidence collection, retrieval and presentation of cybercrime incidence.
3. To track the details of the computer in past using Last Activity view tool
4. To perform data recovery of deleted files using Recuva in Windows.
5. To perform password cracking using any password cracking tool.
6. To perform detail inspection of different file formats using Hex editor
7. To perform data extraction from android phone using AFLogical tool.
8. To perform forensics on whatsapp using Whatsapp Extractor.
9. To perform OS Backdoor using set toolkit.
10. To perform Email Spoofing using SMTP servers.

List of Open Source Software/learning website:

Kali Linux, Wireshark, Recuva, Last Activity tool, AFLogical, Whatsapp Extractor, Free Hex Editor

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722319
Semester – II
Subject Name: Data Preparation and Analysis

Type of course: Regular

Prerequisite: Basics of statistics

Rationale: This course will introduce key concepts for the analysis and development of a meaningful Data Visualizations. In summary, this course will provide a broad view for the data gathering, cleaning and visualization techniques

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues	09
2	Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation	11
3	Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation	13
4	Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity	15

Reference Books:
1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, Glenn J. Myatt and Wayne P Johnson, Wiley
2. Python: Data Analysis and Visualization, Phuong Vo.T.H et al., Packt Publication
3. Data Points, Visulization that means something, Nathan Ayu, Wiley

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722319

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Extract and transform the data into standard format	15%
CO-2	Clean the data before analysis	25%
CO-3	Describe and compare the descriptive statistics of the data	25%
CO-4	Analyze and design the visualization of the data analysis	35%

List of Experiments:

- Minimum 10 experiments based on the above contents.
- Mini Project in a group of max. 3 students
- Writing a research paper on selected topic from content with latest research issues in that topic

Major Equipments:

- Latest PCs with related software

List of Open Source Software/learning website:

- https://www.kdnuggets.com/tag/data-preparation
- https://orange.biolab.si/

Type of course: Master Of Engineering

Prerequisite: Fundamentals of computer network, wireless sensor network, communication & Internet technology, web technology.

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Sr. No.	Syllabus Content	No. of Hours
1	**Introduction IoT & The Internet of Things Today:** What Is IoT? ,Genesis of IoT, IoT and Digitization , IoT Impact, Connected Roadways & Connected Factory,Smart Connected Buildings ,Smart Creatures , Convergence of IT and OT, IoT Challenges.	2
2	**Identification of IoT Objects and Services:** Structural Aspects of the IoT: Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture. Key IoT Technologies: Device Intelligence, Communication Capabilities, Mobility Support , Device Power, Sensor Technology, RFID Technology, Satellite Technology.	4
2	**IoT Network Architecture and Design:** - Comparing IoT Architectures ,The oneM2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, - Layer 1: Physical Devices and Controllers Layer, - Layer 2: Connectivity Layer, - Layer 3: Edge Computing Layer, - Upper Layers: Layers 4–7 ,IT and OT Responsibilities in the IoT Reference Model, Additional IoT Reference Models, A Simplified IoT Architecture, - The Core IoT Functional Stack: - Layer 1: Things: Sensors and Actuators Layer, - Layer 2: Communications Network Layer,Access Network Sublayer: Gateways and Backhaul Sublayer,Network Transport Sublayer,IoT Network Management Sublayer, - Layer 3: Applications and Analytics Layer, Analytics Versus Control Applications, Data Versus Network Analytics, Data Analytics Versus Business Benefits.	8
3	Smart Objects: The "Things" in IoT & Connecting Smart Objects: Sensors, Actuators, and Smart Objects, Sensors, Actuators, Micro-Electro-Mechanical Systems (MEMS),Smart Objects.	10

	• Smart Objects: A Definition, Trends in Smart Objects, Sensor Networks, Wireless Sensor Networks(WSNs), Communication Protocols for Wireless Sensor Networks. • Communications Criteria & IoT Access Technologies: IEEE 802.15.4 ,IEEE 802.15.4g and 802.15.4e , IEEE 1901.2a ,IEEE 802.11ah, LoRaWAN & NB-IoT and Other LTE Variations: Physical Layer, MAC Layer, Topology, Security & Competitive Technologies.	
4	**IP as the IoT Network Layer:** The Business Case for IP, The Key Advantages of Internet Protocol, Adoption or Adaptation of the Internet Protocol, The Need for Optimization, Optimizing IP for IoT. LoWPAN: Header Compression, Fragmentation, Mesh Addressing, Mesh-Under Versus Mesh-Over Routing.	4
5	**Application Protocols for IoT:** The Transport Layer, IoT Application Transport Methods: Application Layer Protocol Not Present, SCADA, A Little Background on SCADA, Adapting SCADA for IP, Tunneling Legacy SCADA over IP Networks, SCADA Protocol Translation, SCADA Transport over LLNs with MAP-T, Generic Web-Based Protocols, IoT Application Layer Protocols, CoAP, Message Queuing Telemetry Transport (MQTT).	8
6	**Internet of Things Applications Examples:** Overview, Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking (Following and Monitoring Mobile Objects), Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.	6

Reference Books

1. IoT Fundamentals, Networking Technologies ,Protocols, and Use Cases for the Internet of Things, David Hanes ,Gonzalo Salgueiro,Patrick Grossetete, Rob Barton, Jerome Henry, Forwarded by Rowan Trollope, Ciscopress.com, Pearson,reprint 2017/2018
2. Building the Internet of Things with IPv6 and MIPv6,The Evolving World of M2M Communications, Daniel Minoli, Willy ,Reprint 2018
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",** 1st Edition, Academic Press, 2014.
4. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013, ISBN: 978-87-92982-96-4 (EBook), ISBN: 978-87-92982-73-5 (Print)
5. Vijay Madisetti and Arshdeep Bahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014.
6. Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications, 2013
7. Cuno Pfister, Getting Started with the Internet of Things, O''Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**12**	**16**	**16**	**08**	**08**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the fundamentals of IoT from a Application design context	10
CO-2	Determine smart objects and its connect	20
CO-3	Understand the application protocols of IoT and its network and interconnecting aspects and rules	20
CO-4	Use of IoT Devices, Gateways and Data Management in various network layer protocols	15
CO-5	Developing IoT Applications	20
CO-6	Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints	15

List of Experiments:

1. Develop simple Smart Metering Application
2. Develop any simple e-Health using body Area Networks sensors like temperature and pressure.
3. Understand City Automation on Any smart city Simulation Tools.
4. Develop Home Automation small Application.
5. Develop Smart Cards based or payment card based using standard Paypal or any other toolkit.
6. Develop Simple racking Application on (Following and Monitoring Mobile Objects).
7. Develop Over-The-Air-Passive Surveillance application simple example
8. Define and Explain Eclipse IoT Project.
9. List and summarize few Eclipse IoT Projects.
10. Sketch the architecture of IoT Toolkit and explain each entity in brief.
11. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
12. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
13. Describe gateway-as-a-service deployment in IoT toolkit.
14. Explain application framework and embedded software agents for IoT toolkit.
15. Explain working of Raspberry Pi.
16. Connect Raspberry Pi with your existing system components.

Major Equipment:

Raspberry pi, Arduino, Google Devices and Google App Engine and its toolkits

List of Open Source Software/learning website:

- https://github.com/connectIOT/iottoolkit
- https://www.arduino.cc/
- http://www.zettajs.org/
- Contiki (Open source IoT operating system)
- Arduino (open source IoT project)
- IoT Toolkit (smart object API gateway service reference implementation)