

# MT-FT-31 SIMULATION AND MODELING

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

**Note:-** Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

## Course Learning Objectives:

1. Fundamentals of creating mathematical models of physical systems and implementation on computers to analyse the system.
2. The different mathematical approaches to modelling that are covered in the course can be characterized into differential and difference equation based models, probability based a model which includes stochastic differential equations, cellular automata and event based approaches, and matrix based models.
3. The course is interdisciplinary in nature and looks at many systems from physics, biology, finance, engineering etc. from a modelling perspective.
4. Each topic is followed by many examples from different disciplines.

## Course Learning Outcomes:

1. to create a relevant model for a multitude of problems from science and engineering, by extracting the necessary and relevant information regarding the problem.
2. They would also be able to define the different modelling terms by analysing the system or the data that is present.
3. They would be able to implement the model on the computer and from the results check for the validity of the model and correctness of the assumptions present in the model.

### Unit-1

Introduction: System Concepts, System boundaries and environment, continuous and discrete systems, system modeling, Type of Models, Modeling Methodology, Model validation, Principles & Nature of Computer modeling and simulation, Steps in Simulation Study, Pitfalls in Simulation, When to use Simulation?, Physical and Interactive Simulation, Real-Time Simulation, Simulation and Analytical Methods, Areas of Application.

### Unit-II

Continuous & Discrete: Analog vs. Digital Simulation, Continuous simulation vs. Numerical Integration; Time Flow Mechanism, Concepts of simulation of continuous and discrete system with the help of live examples- Pure Pursuit Problem, Inventory Problem, Chemical Reactor; Generation of random numbers, Monte Carlo Computation vs Stochastic Simulation, Generation of non-uniformly distributed random numbers, Discrete Probability Functions, Cumulative Distribution Function, Measures of Probability Function-Central Tendency & Dispersion, Generation of Poisson and Erlang variates.

### Unit III

Simulators for the live systems: Simulation of a water reservoir system, Simulation of a hypothetical Computer. Simulation of queuing Systems: Basic concepts of queuing theory, Simulation of single-server, two server and general queuing systems, Simulation in Inventory Control systems : Elements of inventory theory, inventory models, simulators for complex Inventory systems.

### Unit IV

Design and Evaluation of Simulation Experiments: Length of simulation run, variance reduction techniques. Experiment layout and Validation. Simulation Languages: Continuous and discrete simulation languages, Block-Structured continuous simulation languages,

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Expression based languages, discrete system simulation languages: GPSS, SIMSCRIPT, SIMULA, Factors in selection of discrete system simulation languages.

**Text/Reference Books:**

1. Gordon G.: "System Simulation" , Prentice-Hall of India Pvt. Ltd. New Delhi 1993.
2. Narsingh Deo: "System Simulation with Digital Computer:", PHI New Delhi, 1993
3. Neelamkavil Frances: "Computer Simulation and modelling, John Wiley & Sons, New York 1987,
4. Payne, James A.: " Introduction to Simulation: Programming Techniques and Methods of Analysis, McGraw-Hill International Editions, Computer Science Services, New York(1998).
5. Reitman Julian: "Computer Simulation Experiments", Wiley- Interscience, 1971.

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## MT-FT-32 RESEARCH METHODOLOGY

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

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### Course Learning Objectives:

1. Identify and discuss the role and importance of research in the social sciences.
2. Identify and discuss the issues and concepts salient to the research process.
3. Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
4. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

### Course Learning Outcomes:

1. Explain key research concepts and issues
2. Read, comprehend, and explain research articles in their academic discipline.

### UNIT I

Objectives and types of Research: Motivation and Objectives- Research Methods vs. Methodology, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Research Formulation: Defining and formulating the research problem-. Selecting the problem, necessity of defining the problem, Importance of Literature Review in defining a problem, literature review- Primary and secondary source reviews, Hypothesis- Definition, Qualities of a good hypothesis, null hypothesis and alternatives.

### UNIT II

Research design and methods: Basic principles, Need of research design- features of good design, Important concepts relating to research design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Sampling Methods, Measurement: Concept of measurement, Problems in measurement in research - Validity and Reliability. Levels of measurement- Nominal, Ordinal, Interval, Ratio.

### UNIT III

Data Collection and Analysis: Execution of the research, observation and collection of data, methods of data collection, data processing and analysis strategies, data analysis with statistical packages, hypothesis testing, generalization and Interpretation, Univariate Analysis (frequency tables, bar charts, pie charts, percentages).

### UNIT IV

Meaning of Interpretation, Need of Interpretation, Technique of Interpretation, Precaution in Interpretation, Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Reports and Thesis Writing: Structure and components of scientific reports, Types of report- Technical reports and thesis, Writing-synopsis, abstract, illustrations and tables, results, summary, reference citing and Listing.



### Text/Reference Books:


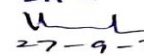
1. J. Garg, B.L., Karadia, R., Aggarwal, F, and Aggarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.

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2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
3. N, Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C., Design and Analysis of Experiments, Wiley India Pvt. Ltd.

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## MT-FT-33(i) CLOUD COMPUTING

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

**Note:-**Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

### Course Learning Objectives

1. Basics of cloud computing.
2. Key concepts of virtualization.
3. Different Cloud Computing services
4. Cloud Implementation, Programming and Mobile cloud computing
5. Cloud Backup and solutions

### Course Learning Outcomes:

1. Define Cloud Computing and memorize the different Cloud service and deployment models
2. Describe importance of virtualization along with their technologies.
3. Use and Examine different cloud computing services
4. Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing
5. Describe the key components of Amazon web Service
6. Design & develop backup strategies for cloud data based on features

### UNIT I

**Introduction:** Essentials, Benefits and need for Cloud Computing - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption.

**Cloud Models:** Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud Public versus Private Clouds - Cloud Infrastructure Self Service

**Cloud as a Service:** Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined

### UNIT II

**Cloud Solutions:** Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

**Cloud Offerings:** Information Storage, Retrieval, Archive and Protection - Cloud Analytics Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud.

**Cloud Management:** Resiliency – Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering.

### UNIT III

**Cloud Virtualization Technology:** Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements.

**Cloud Virtualization:** Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center.

### UNIT IV

**Cloud and SOA:** SOA Journey to Infrastructure - SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services.

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**Cloud Infrastructure Benchmarking:** OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV Benchmarks - Cloud Performance Data Collection and Performance Monitoring Commands - Benchmark Tools.

**Text/Reference Books:**

1. Roger Jennings, *Cloud Computing*, Wiley India
2. John Rhoton, *Cloud Computing Explained*, Recursive Press
3. Barry Sosinsky, *Cloud Computing Bible*, Wiley
4. Rajkumar Buyya, James Broberg, *Cloud Computing: Principles and Paradigms*, Wiley
5. Judith Hurwiz, *Cloud Computing for Dummies*, Wiley Publishing.
6. Rosenberg and Matheos, *The Cloud at your service*, Manning Publications
7. Dr. Kumar Saurabh, *Cloud Computing – Insight into New Era Infrastructure*, Wiley India.

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## MT-FT-33(ii) GRID COMPUTING

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

**Note:-**Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

**Course Learning Objectives:** The course is aimed at following:

1. To discuss the basic idea behind the grid computing.
2. To learn the concepts of grid security and resource management.
3. To understand the concept of grid portals
4. To learn the concept of grid middleware.
5. To learn how to set up and administer a grid

**Course Learning Outcomes:** At the end of the course, a student will possess the following:

1. A fair knowledge about the objectives of grid computing
2. A fair knowledge of grid computing and its basic principles
3. Knowledge about the cost efficient and high performance computing systems
4. Idea about the concepts related to design and architecture of grid computing
5. A basic knowledge about the technology application for grid computing.

### UNIT I

**Introduction:** Cluster and Grid computing, Meta-computing, Web services and Grid Computing, e-Governance and the Grid

**Technologies and Architectures for Grid Computing:** Issues in Data Grids, Functional requirements in Grid Computing, Standards for Grid Computing, Recent technologies trends in Large Data Grids.

**Web Services and the Service Oriented Architecture:** Service Oriented Architecture, SOAP and WSDL, Creating Web Services, Server Side.

### UNIT II

**OGSA and WSRF:** OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF, WSRF Specification

**Globus Toolkit:** History, version, Applications, Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data Choreography and Coordination, GT4 Architecture, GT4 Containers.

**The Grid and Databases:** Requirements, Storage Request Broker, Integration of Databases with the Grid, Architecture of OGSA-DAI for offering Grid Database services.

### UNIT III

**Cluster Computing:** Approaches to Parallel Computing, Definition and Architecture of a Cluster, Categories of clusters.

**Cluster Middleware:** Levels and Layers of Single System Image, Design objectives, Resource Management and Scheduling, Cluster programming Environment and Tools.

**Networking, Protocols and I/O for clusters:** Networking and Interconnection/Switching Devices, Design Issues, Design Architecture, HiPPI, ATM, Myrinet, Memory Channel

### UNIT IV

**Setting Up and Administering a Cluster:** Setup of simple cluster, setting up nodes, clusters of clusters, System monitoring, Global Clocks Sync.

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**Cluster Technology for High Availability:** High availability clusters, high availability parallel computing, types of failures and errors, cluster architectures and configurations for high availability, Failure/Recovery clusters.

**Process Scheduling:** Job management System, Resource management system, policies of resource utilization, Scheduling policies.

**Load Sharing and Load Balancing:** Introduction, Strategies for load balancing, Modelling parameters.

**Text/Reference Books:**

1. Grid and Cluster Computing by C.S.R. Prabhu, PHI
2. The Grid: Blueprint for a New Computing Infrastructure, Ian Foster, Carl Kesselman, Elsevier Series, 2004.
3. Grid Computing for Developers, Vladimir Silva, Charles River Media, January 2006.
4. Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies, High Performance Computing: Paradigm and Infrastructure, Laurence Yang and Minyi Guo (editors), Wiley Press, New Jersey, USA, June 2005. 4
5. Grid Resource Management: State of the Art and Future Trends, Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, International Series in Operations Research & Management Science, Springer; First edition, 2003

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## MT-FT-33(iii) QUANTUM COMPUTING

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

**Note:-**Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

**Course Learning Objectives:** The course is aimed at following:

1. To introduce the fundamentals of quantum computing
2. To understand the problem solving approach using finite dimensional mathematics
3. To learn the algebra of complex vector spaces and quantum mechanics

**Course Learning Outcomes:** On successful completion, students will gain understanding about:

1. The basic principles of quantum computing.
2. The fundamental differences between conventional computing and quantum computing.
3. Several basic quantum computing algorithms.
4. The classes of problems that can be expected to be solved well by quantum computers.

### UNIT I

Introduction to Quantum Computation: Concept and need of quantum computing, Quantum bits and quantum operations, Postulates of quantum mechanics, Bloch sphere representation of a qubit, multiple qubits, classical gates versus quantum gates.

### UNIT II

Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits

### UNIT III

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem, Quantum programming languages, Probabilistic and Quantum computations.

### UNIT IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation



### Text/Reference Books:


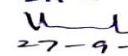
1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
2. Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, Benenti G., Casati G. and Strini G., World Scientific, 2004.
3. An Introduction to Quantum Computing Algorithms, Pittenger A. O., 2000.
4. Quantum computing explained, David McMahon, John Wiley & Sons, Inc. Publication 2008

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5. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010
6. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

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## MT-FT-34(i) DATA WAREHOUSING AND DATA MINING

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

**Note:-** Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

### Course Learning Objectives

1. To identify the scope and essentiality of Data Warehousing and Mining.
2. To analyze data, choose relevant models and algorithms for respective applications.
3. To study spatial and web data mining.
4. To develop research interest towards advances in data mining.

### Course Learning Outcomes:

1. Understand Data Warehouse fundamentals, Data Mining Principles
2. Design data warehouse with dimensional modeling and apply OLAP operations.
3. Identify appropriate data mining algorithms to solve real world problems
4. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
5. Describe complex data types with respect to spatial and web mining.
6. Benefit the user experiences towards research and innovation. Integration.

### Unit I

Data Mining: Introduction: Motivation, Importance, data mining, kind of data, Functionalities, interesting patterns, classification of data mining system, Major issues, Data Mining Primitives.

Data Preparation: Preprocess, Data cleaning, Data Integration and transformation, Data reduction, Discretization and concept hierarchy generation.

### Unit II

Data warehouse and OLAP Technology for data mining: data warehouse, difference between operational data base systems and data warehouse, A Multidimensional Data Model, Architecture, Implementation, data warehousing to data mining, Data warehouse usage.

### Unit III

Association Rule Mining: Mining single-dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, constraint-based association Mining.

### Unit IV

Classification and prediction, issues, classification by decision induction, Bayesian classification, classification by back propagation, classification based on concepts from association rule mining other classification methods .Cluster Analysis: What is Cluster Analysis, Types of Data in Cluster Analysis, Applications and Trends in Data Mining.

### Text/Reference Books:

1. Ale Berson, Stephen Smith, Korth Theorling, *Data Mining*, TMH.
2. Adruaans, Longman, Addison-Wesley *Data Mining*,
3. Addison-Wesley Longman, *Data Warehousing in the Real World*.
4. Chanchal Singh, *Data Mining and Warehousing*, Wiley.
5. John E, Herbert P, *Data Mining*.

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## MT-FT-34(ii) BIG DATA ANALYTICS

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

### Course Learning Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

### Course Learning Outcomes:

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

### UNIT I

Introduction, Wholeness of Big Data, Big Data Sources and Applications, Big Data Architecture.

### UNIT II

Distributed Computing Using Hadoop, Parallel Processing with Map Reduce, Application and Programming. NoSQL Databases, Big Data Programming Languages – Apache Hive, Apache Pig.

### UNIT III

BIG DATA PRIVACY, ETHICS AND SECURITY - Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? , Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security

### UNIT IV



SECURITY, COMPLIANCE, AUDITING, AND PROTECTION- Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems, HADOOP SECURITY DESIGN Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration, DATA SECURITY & EVENT LOGGING Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster.


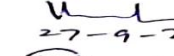
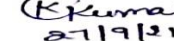
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1. Mark Van Rijmenam, "Think Bigger: Developing a Successful Big Data Strategy for Your Business", Amazon, 1 edition, 2014.
2. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley & Sons, 2013.
3. SherifSakr, "Large Scale and Big Data: Processing and Management", CRC Press, 2014.
4. Sudeesh Narayanan, "Securing Hadoop", Packt Publishing, 2013.
5. Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.
6. Boris Lublinsky, Kevin Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
7. Chris Eaton, Dirk Deroos et al., "Understanding Big data ", McGraw Hill, 2012. 3. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012

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## MT-FT-34(iii) DATA SCIENCE

L/T - 4

Total Credits – 4

Internal - 30 Marks

External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

### Course Learning Objectives:

1. To know the fundamental concepts of data science and analytics
2. To learn various techniques for mining data streams
3. To learn event modelling for different applications.
4. To know about Hadoop and Map Reduce procedure

**Course Learning Outcomes:** Upon the completion of the course the student should be able to:

1. Work with big data platform and its analysis techniques.
2. Design efficient algorithms for mining the data from large volumes.
3. Model a framework for Human Activity Recognition
4. Development with cloud databases

### UNIT I

INTRODUCTION TO DATA SCIENCE – Applications - Data Science Process – Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

### UNIT II

DATA ANALYSIS: Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics –

### UNIT III

DATA MINING TECHNIQUES: Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.

### UNIT IV

FRAMEWORKS AND VISUALIZATION: Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.

### Text/Reference Books

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

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2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
5. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Publishers, 2013.
6. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly Publishers, 2013.
7. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014.
8. S. N. Sivanandam, S. N Deepa, "Introduction to Neural Networks Using Matlab 6.0", Tata McGraw- Hill Education, 2006.



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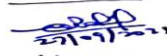
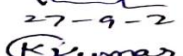
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**MT-FT-41 — DISSERTATION**

<b>Course No.</b>	<b>Course Title</b>	<b>Credit</b>	<b>Internal</b>	<b>External</b>	<b>Total</b>
MT-FT-41	Dissertation	14	100	250	350
<b>Total</b>		<b>14</b>	<b>100</b>	<b>250</b>	<b>350</b>

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