Guru Nanak Dev Engineering College, Ludhiana

Department of Information Technology

Syllabus

M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-109

Subject Name: Digital Forensics

Programme: M.Tech. (IT)	**L:**3 **T:**0 **P:**0
Semester:2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**20%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 150	**Course Status:** Programme Core

Prerequisites: Cyber Security

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze the various mechanism of computer forensics.
2.	Employ various computer tools to investigate cyber-crime scene
3.	Conclude the cyber forensic investigation by creating investigative reports
4.	Analysis and understanding the real case studies and examining the digital evidence.
5.	Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools

Detailed Contents:

UNIT-I **09 hours**

Introduction to Computer Forensics:- Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalities area, holistic approach to cyber-forensics.

UNIT-II **09 hours**

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.

UNIT-III **09 hours**

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.

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UNIT-IV **09 hours**

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, and complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Text Books:

1. Computer Forensics and cybercrimes: An introduction by Marjie T. Britz, Pearson Education, India.2013
2. Investigating the Cyber Breach: The digital forensics guide for the network engineer by Joseph Muniz and Aamir Lakhani, Pearson Education India.2018

Reference Books:

1. John Sammons, The Basics of Digital Forensics, Elsevier, 2014.
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications, 2015.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-110

Subject Name: Advanced Data Structures

Programme: M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester:2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 150	**Course Status:** Programme Core

Prerequisites: UG level course in Data Structures.

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Design and implementation of symbol table using hashing techniques.
2.	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3.	Develop algorithms for text processing applications.
4.	Identify suitable data structures and develop algorithms for computational geometry
5.	Apply algorithms to real world problems

Detailed Contents:

UNIT-I 09 hours Dictionaries and Hashing: Definition, Dictionary Abstract Data Type, Implementation of
dictionaries. Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT-II

09 hours

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

UNIT-III

08 hours

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees R.

UNIT-IV

10 hours

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Text Books:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++,* 2nd Edition, Pearson, 2013.
2. M T Goodrich, Roberto Tamassia, *Algorithm Design*, John Wiley, 2002.
3. Peter Brass ,*Advanced Data Structures*, 1st Edition, Publisher: Cambridge University Press; 1 edition 2008

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Algorithms4th Edition, Addison-Wesley Professional; 4th edition (April 3, 2011)
2. Tim Buchalka, Goran Lochert, Tim Buchalka's Learn Programming Academy, Data Structures and Algorithms: Deep Dive Using Java, 2019

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-113

Subject Name: Advanced Bioinformatics

Programme: M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester: 2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**15%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Probability and Statistics, Data Structures and Algorithm

Additional Material Allowed in ESE: Nil

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze various Bioalgorithms and tools like Point Accepted Mutation (PAM), Blocks Substitution Matrix (BLOSUM) etc.
2.	Examine and conceptualize the concepts of Alignment and Gene Prediction Methods.
3.	Identify and quantify Protein Structure and Modeling.
4.	Comprehend the usage if Bioinformatics in Computer-aided Drug Design.
5.	Implementation of various Biomolecular and Simulation packages.

Detailed Contents:

UNIT-I **10hours**

Bioalgorithms and Tools: Introduction, Concept of Alignment, Sequence Alignment, Scoring Matrices, Point Accepted Mutation (PAM), BLOcks SUbstitution Matrix (BLOSUM), Alignment of Pairs of Sequences, Alignment Algorithms, Heuristic Methods, Multiple Sequence Alignment

Gene Prediction Methods: Introduction, Biological Overview, Gene Prediction, Computational Methods of Gene Prediction, Methods of Gene Prediction, Combination of Two Methods, Complexities regarding Gene Prediction.

UNIT-II **08hours**

Protein Structure and Modeling: Protein and Secondary Structure Prediction, Levels of Protein Structure, Conformational Parameters of Secondary Structure of a Protein, Secondary Structure Types, Secondary Structure Prediction, Software's for Secondary Structure Prediction, Limitations of Secondary Structure Prediction.

UNIT-III 10 hours Bioinformatics in Computer-aided Drug Design: Introduction, The Drug Discovery Process, Structural Bioinformatics in Drug Discovery, Structure-Activity Relationship (SAR) and
Quantitative Structure-Activity Relationship (QSAR) Techniques in Drug Design, Graph Theory, Molecular Docking, Briefing on Drug Bank, AutoDock- The Docking Software and Auto Dock Tools (ADT)

UNIT-IV **08hours**

Modeling of Biomolecular Systems: Introduction, Monte Carlo Methods, Molecular Dynamics, Energy Minimization, Leading Molecular Dynamics (MD) Simulation Packages, Markov Chains and Hidden Markov Model (HMM), Application of Viterbi Algorithm, Application of HMMs to specific problems, Advantages of HMM, Genetics Computer Group (GCG) Wisconsin Package

Text Books:

1. Rastogi, S.C., Mendiratta, N., Rastogi, P. (2018). *Bioinformatics: Methods and Applications - Genomics, Proteomics and Drug Discovery* (4th ed.). India: PHI Learning.
2. Antao, T. (2015). *Bioinformatics with Python Cookbook* (2nd ed.). Birmingham, UK: PACKT Publishing.
3. Ghosh, Z. and Mallick, B. (2013). *Bioinformatics: Principles and Applications* (4th ed.). UK: Oxford University Press.

Reference Books:

1. Bergeron, B. (2017). *Bioinformatics Computing* (4th ed.). India: Prentice Hall Inc.
2. Ignacimuthu, S. (2013). *Basic Bioinformatics* (3rd ed.). India, New Delhi: Narosa Publishing House Pvt. Ltd.

E-Books and online learning material

1. An Introduction to Bioinformatics Algorithms by Neil C. Jones and Pavel A. Pevznerhttp://www.cs.ukzn.ac.za/~hughm/bio/docs/IntroToBioinfAlgorithms.pdf Accessed on Dec. 09, 2019
2. Protein Structure Prediction by Sitao Wu and Yang Zhang
https://zhanglab.ccmb.med.umich.edu/papers/2009_8.pdfAccessed on Dec.10, 2019

Online Courses and Video Lectures

1. http://bix.ucsd.edu/bioalgorithms/presentations/Ch08_GraphsDNAseq.pdf Accessed on Dec.10, 2019
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5187414/ Accessed on Dec. 14, 2019

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-114

Subject Name: : Data Analytics

Programme: M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester: 2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Data Mining, Machine Learning, Programming skills, Soft Computing.

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Demonstrate proficiency with statistical analysis of data.
2.	Graphically interpret data.
3.	Identify the risks and risk management.
4.	Implement large scale analytics projects from various domains.
5.	Develop applications based on Agile Framework.

Detailed Contents:

UNIT-I **09 hours**

Data Analytics and Project Management: Key role of data analytics in the process of driving change in project management, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming.

UNIT-II

09 hours

Categories of Analytics and Risk Management: Descriptive Analytics, Predictive Analytics, Perspective Analytics, Measures of central tendency, Measures of location of dispersions, Practice and analysis with R, Risk Management Process, Establishing Tolerance, Data Collection risk and risk collection, Exploratory risks in data analytics, Confirmatory Analytics risks, predictive risks in data analytics, risks in communicating results, resolving data analytics risks.

UNIT-III

09 hours

Basic analysis techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Regression analysis, Practice and analysis with R.

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UNIT-IV

09 hours

Agile Project Management and Data Analytics: Introduction, The Changing Data Landscape, Volume, Variety , Velocity and Veracity, CRISP-DM and Agile Methodology, Agile Principles and Cross-industry standard process for data mining (CRISP-DM) Alignment, Challenges of Agile Software Development Applied to Data Analytics, Future Trends in Agile and Data Analytics, Data Analytics and Scrum, Agile, SCRUM and Data Analytics in Online Transactional Processing (OLTP) and Online Analytical Processing (OLAP).

Text Books:

1. Seweryn Spalek, “Data Analytics in Project Management”, 6th Edition, CRC Press – Taylor and Francis Group, 2019.
2. G. James, D. Witten, T Hastie, and R. Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer, 2013.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, “Probability & Statistics for Engineers & Scientists”, Prentice Hall Inc.”, 9th Edition.

Reference Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *“Probability & Statistics for Engineers & Scientists*”, (9th Edition.), Prentice Hall Inc.
2. Trevor Hastie Robert Tibshirani Jerome Friedman, “*The Elements of Statistical Learning, Data Mining, Inference, and Prediction*” (2nd Edition.), Springer, 2014.
3. Anna Maria Paganoni and Piercesare Secchi, “*Advances in Complex Data Modeling and Computational Methods in Statistics*”, Springer, 2013.
4. Mark Gardener, “*Beginning R: The Statistical Programming Language*”,

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-115

Subject Name: : Social Networking

Programme: M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester: 2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Data Mining, Recommender Systems.

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze dynamics and evolution of social networks
2.	Demonstrate the development of social structures
3.	Implement the framework of network analysis
4.	Apply the concept of network centrality with various concepts like betweenness, closeness, page ranks etc.
5.	Implement various community concepts like: clustering, community structure, modularity

Detailed Contents:

UNIT-I **09 hours**

Random network models: nodes, edges, adjacency matrix, one and two-mode networks, node degree, Erdos-Renyi and Barabasi-Albert Concepts: connected components, giant component, average shortest path, diameter, breadth-first search, preferential attachment.

UNIT-II

09 hours

Network centrality and Community: Betweenness, closeness, eigenvector centrality (+ PageRank), network centralization, clustering, community structure, modularity, overlapping communities.

UNIT-III

09 hours

Small world network models, optimization, strategic network formation and search: geographic networks, decentralized search, Simple contagion, opinion formation, coordination and cooperation, threshold models, unusual applications of Social Network Analysis (SNA).

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UNIT-IV

09 hours

SNA and online social networks: how services such as Facebook, LinkedIn, Twitter, Couch Surfing, using SNA to understand their users and improve their functionality

Text Books:

1. John Scott, Social Network Analysis, 3rd Edition, SAGE Publications, 2013.
2. Song Yang, Franzisca B.Kellar, Lu Zheng, Social Network Analysis: Methods and Examples, SAGE Publications, 2017.
3. Wouter de Nooy, Andrej Mrvar, Vladimir Batagelj, Exploratory Social Network Analysis with Pajek, 2nd Revised Edition, Cambridge University Press, 2011.

Reference Books:

1. Patrick Doreian, Frans Stokman, Evolution of Social Networks, Routledge, 2013.
2. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-116

Subject Name: Machine Learning - II

Programme:M.Tech.(I.T.)	**L:**3 **T:**0 **P:** 0
Semester:2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Soft Computing, Machine Learning - I

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze the mathematical foundations for execution of different Machine Learning Algorithms
2.	Evaluate data based on Machine Learning Predictions
3.	Implement the Machine Learning Model using third generation Neural Networks
4.	Apply different genetic algorithms for the specific problems.
5.	Evaluate the Deep Learning Methodologies.

Detailed Contents:

UNIT-I **12hours**

Introduction: Statistical Learning Perspective, Computer Science Perspective, Models and Algorithms: Learning a Function, Learning a Function to Make Predictions, Techniques For Learning a Function, Supervised, Unsupervised and Semi-Supervised Learning, Steps in Machine Learning Process, Loss Functions in Machine Learning, Gradient Descent, Gradient Descent Variations, Model Selection and Evaluation, Machine Learning Visualization, Classify images, regression, classify structured data, text classification, underfitting and overfitting, save and restore models.

Nonlinear Algorithms: Classification and Regression Trees (CART): Decision Trees, CART Model Representation, Making Predictions, Learn a CART Model From Data, Preparing Data For CART, Making Predictions on Data, Naive Bayes: Introduction to Bayes' Theorem, Naive Bayes Classifier, Gaussian Naive Bayes, Preparing Data For Naive Bayes, Make Predictions with Naive Bayes, Gaussian Naive Bayes: Gaussian Probability Density Function, Learn a Gaussian Naive Bayes Model, Make Prediction with Gaussian Naive Bayes, K-Nearest Neighbors (KNN): KNN Model Representation, Making Predictions with KNN, Curse of Dimensionality, Preparing Data For KNN, KNN and Euclidean Distance, Making Predictions with KNN .

UNIT-II **08hours**

Third Generation Neural Networks: Introduction, Spiking Neural Networks: Architecture, Izhikevich Neuron Model, Encoding of Neurons in SNN, Learning with Spiking Neurons, Spike Prop Learning Algorithm, Spike Time-Dependent Plasticity (STDP) Learning, Convolution Neural Networks: Layers, Architecture, Limitations, Deep Learning Neural Networks: Network Model and Process Flow, Training Algorithm, Encoder Configurations, Extreme Learning Machine Model (ELM): Architecture, Online Extreme Learning Machine, Pruned Extreme Learning Machine, Improved Extreme Learning Machine Models, Applications.

UNIT-III **08hours**

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Operators in Genetic Algorithm: Encoding, Selection, Crossover, Mutation, Constraints in Genetic Algorithm, Classification of Genetic Algorithm: Messy Genetic Algorithms, Adaptive Genetic Algorithms, Hybrid Genetic Algorithms, Parallel Genetic Algorithms, Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition

UNIT-IV 08hours Deep Learning: Introduction, Historical Trends in Deep Learning: Increasing Dataset Sizes,
Increasing Model Sizes, Increasing Accuracy, Complexity and Real-World Impact, Mathematical Foundations of Deep Learning, Introduction to Tensors, Data pipelines, text processing.

Text Books:

1. Alpaydin E. (2010). *Introduction to Machine Learning*, MIT Press.
2. Sivanandam, S.N., Deepa, S.N. (2019). *Principles of Soft Computing* (3rd ed.), Wiley India Pvt. Ltd.
3. Rajasekaran, S., VijayalakshmiPai, G.A. (2013). *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI Learning Pvt. Ltd.
4. Goodfellow, I., YoshuaBengio, Courville I., Bach, F. (2017). *Deep Learning*, Adaptive Computation and Machine Learning series, MIT Press.
5. AurelienGeron (2017). *Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems* (2nd ed.) Shroff/O'Reilly.

Reference Books:

1. Michie D., Spiegelhalter D. J., Taylor C. C. (2009) *Machine Learning, Neural and Statistical Classification*. Overseas Press.
2. Murphy, K. (2012). *Machine Learning: A Probabilistic Perspective*, MIT Press.
3. Hastie T., Tibshirani, R., Friedman, J. (2009). *The Elements of Statistical Learning*, Springer.
4. Bishop, C. (2007) *Pattern Recognition and Machine Learning*, Springer.

5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009
6. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-117

Subject Name: Parallel and Distributed Computing

Programme:M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester:2	**Teaching Hours:**36 Hours
Theory/Practical: Theory	**Credits:**
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Knowledge of Database, Data Science

Additional Material Allowed in ESE:NIL

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Learn the concepts, issues and tasks in parallel and distributed computing along with different parallel architectures
2.	Demonstrate the principles for Parallel Algorithm Design.
3.	Explore the parallel programming models and algorithms for common operations.
4.	Analyze the application of parallel algorithms to solve the complex computational problems.
5.	Implement various parallel algorithms with CUDA

Detailed Contents:

UNIT-I **10hours**

Introduction: Scope, issues, applications and challenges of Parallel and Distributed Computing Parallel

Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, co-processing.

Principles of Parallel Algorithm Design: Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing.

UNIT-II **11 hours**

CUDA programming model: Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.

Analytical Modelling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time

UNIT-III **07hours**

Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix- Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms

UNIT-IV **12hours**

Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph

Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

Textbooks:

1. A Grama, A Gupra, G Karypis, V Kumar (2003) . *Introduction to Parallel Computing* (2nd Ed.). Addison Wesley. 2. C Lin, L Snyder (2008). *Principles of Parallel Programming*. USA: Addison-Wesley Publishing Company.
3. Michael Quinn (2017). *Parallel Computing* (2^{ND} ed): Theory and Practice McGraw Hill Education

Reference Books:

1. J Jeffers, J Reinders (2013). *Intel Xeon Phi Coprocessor High-Performance Programming*. Morgan KaufmannPublishing andElsevier.
2. T Mattson, B Sanders, B Massingill(2004). *Patterns for Parallel Programming*. Addison Wesley Professional.
3.Arun Kulkarni, Nupur Prasad Giri, Nikhilesh Joshi, Bhushan Jadhav (2017).*Parallel and Distributed Systems*(2^{nd} ed.), Wiley.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MIT-118

Subject Name: Components and Applications of IoT

Programme: M.Tech.(IT)	**L:**3 **T:**0 **P:**0
Semester: 2	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 150	**Course Status:** Elective

Prerequisites: Fundamentals of Computer Networks, Wireless Sensor Network, Communication and Internet Technology, Web Technology, Information Security

Additional Material Allowed in ESE: Nil

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze IoT applications, services and business process designs with minimum complexities.
2.	Examine and conceptualize the concepts of SOAP, REST, HTTP RESTful and WebSockets.
3.	Quantify Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks.
4.	Comprehend the advanced concepts in IoT Privacy, Security and Vulnerabilities Solutions.
5.	Implement the IoT concepts while learning the various case studies.

Detailed Contents:

UNIT-I **12hours**

Design Principles for Connected Devices: Introduction,Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway, Ease of Designing and Affordability.

Design Principles for Web Connectivity: Introduction, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected-Devices Network using Gateway, SOAP, REST, HTTP RESTful and Web Sockets.

UNIT-II **08hours**

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Introduction, Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology.

UNIT-III **08hours**

IoT Privacy, Security and Vulnerabilities Solutions: Introduction, Vulnerabilities, Security Requirements and Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and

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Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT .

UNIT-IV **08hours**

IoT Case Studies: Introduction, Design Layers, Design Complexity and Designing using Cloud PaaS, IoT/IIot applications in the premises, Supply-Chain and Customer Monitoring, Connected Car and its applications with services, IoT applications for smart homes, cities, environment monitoring and agriculture, Case study: Smart City Streetlights Control and Monitoring.

Text Books:

1. CunoPfister, “Getting started with the Internet of Things”, O’Reilly Media, 2011.
2. ArshdeepBahga and Vijay Madisetti, “Internet of Things – A Hands-on approach”, University press, 2015.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable approach of connecting everything”, Apress Publications, 2013.

Reference Books:

1. M. Richardson and S. Wallace, “*Getting started with Raspberry Pi*”, O’Reilly (SPD), 2014.
2. R.L. Krutz and R.D. Vines, “*Cloud Security: A Comprehensive Guide to Secure Cloud Computing*”, Wiley-India, 2010.

E-Books and online learning material

1. IoT Design Principles by George Cora and David Mohr.https://www.slideshare.net/ardexateam/iot-design-principles-79806278 Accessed on Dec. 09, 2019

2. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally. https://madsg.com/wp-content/uploads/2015/12/Designing_the_Internet_of_Things.pdf Accessed on Dec. 15, 2019

Online Courses and Video Lectures

1. https://www.futurice.com/blog/7-design-principles-for-iot Accessed on Dec.10, 2019
2. https://www.seebo.com/iot-design/ Accessed on Dec. 14, 2019
3. https://www.kdnuggets.com/2017/01/internet-of-things-tutorial-chapter-2-wsn-rfid-forerunners.html Accessed on Dec. 13, 2019

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: MAC-102

Subject Name: Pedagogy Studies

Programme:M.Tech.(IT)	**L:**2**T:**0 **P:**0
Semester:2	**Teaching Hours:** 24 Hours
Theory/Practical: Theory	**Credits:**0
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems: Nil**
External Marks:NIL	**Duration of End Semester Exam(ESE): NIL**
Total Marks:50	**Course Status:** Audit Course

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analyze the pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2.	Examine the effectiveness of the pedagogical practices
3.	Reckon out the methods how teachers can use various pedagogical practices for effective classroom teaching.
4.	Ability to design Research problems
5	Explore the various barriers for learning

Detailed Contents:

UNIT-I **8 hours**

Introduction andMethodology: Aims and rationale, Policy background, Conceptual framework and terminology**,** Theories of learning, Curriculum, Teacher education, Research questions, Overview of methodology and Searching**,** Thematic cover view: Pedagogical practices being used by teachers informal and informal classrooms in developing countries.

UNIT-II **08hours**

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

UNIT-III **04hours**

Professional Development: Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to Learning: limited resources and large class sizes

UNIT-IV **04 hours**

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment and Dissemination and research impact.

Text Books:

1. Abraham Silberschatz, S. Sudarshan, Henry F. Korth, “Database System Concepts”, 6th Edition, Tata McGraw - Hill Education, 2011.
2. Shamkant B. Navathe, RamezElmasri, “Fundamentals of Database Systems”, 6th Edition, Addison Wesley Pub Co Inc, 2010.
3. Connolly, “Specifications of Database Systems : A Practical Approach to Design, Implementation and Management”, 4th Edition, Pearson India, 2008.

Reference Books:

1. AkyeampongK,LussierK,PryorJ,WestbrookJ(2013)Improving teaching and learning of basic mathsandreadinginAfrica:Doesteacherpreparationcount? InternationalJournalEducational Development, 33 (3):272–282.
2. AlexanderRJ(2001)Cultureandpedagogy:Internationalcomparisonsinprimaryeducation. Oxford and Boston: Blackwell.
3. ChavanM(2003)ReadIndia:Amassscale,rapid,‘learningtoread’campaign.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-109

Subject Name: Digital Forensics Laboratory

Programme: M.Tech.(IT)	**L:**0 **T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Theory	**Credits:**1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**60%
External Marks: 50	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Course Status:** Core

Prerequisites: Data mining, cyber laws, e-discovery tools

Additional Material Allowed in ESE:

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Understanding the cyber forensic investigation by creating investigative reports.
2.	Create various methods for carrying out computer forensic practices
3.	Employ various computer tools to investigate cyber-crime scene
4.	Analysis and understanding the real case studies and examining the digital evidence
5.	Investigate the cases and generate the results for validation.

Detailed Contents:

Practical 1: Download and installation of SANS SWIFT Workstation, a collection of forensic tool and Kali Linux

Practical 2: Understand Hashing using (hash-identifier, md5sum)

Practical 3: Volatile data gathering from a Linux/Unix systemusing LIME

Practical 4: Forensic Imaging of Drives for Linux/Unix System using dd/dcfldd

Practical 5: Windows volatile data acquisition using Helix

Practical 6: Windows memory analysis using volatility

Practical 7: Windows Registry Analysis using Windows Registry Analysis

Practical 8: Forensic Imaging of Drives using FTK imager

Links for practical demonstration

https://digital-forensics.sans.org/community/download-sift-kit/3.0

https://www.kali.org/downloads/

https://github.com/504ensicsLabs/LiME

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-110

Subject Name: Advanced Data Structures Laboratory

Programme: M.Tech.(IT)	**L:T:** 0 **P:** 2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 01
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 50	**Duration of End Semester Exam (ESE):**03 Hours
Total Marks: 100	**Course Status:** Core

CO #	Course Outcomes
1.	Select appropriate data structures to reckon out the ADT/libraries and use it to design algorithms for a specific problem.
2.	Explore the necessary mathematical abstraction to solve problems.
3.	Familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Develop algorithm for various hashing techniques.
5.	Quaternary structural analysis.

LIST OF EXPERIMENTS

1. Write a program to insert, delete and traverse elements in sorted singly linked list.
2. Write a program to insert, delete and traverse elements in sorted doubly linked list.
3. Write a program to implement static hashing using linear probing as overflow technique.
4. Write a program to implement static hashing using chaining as overflow technique.
5. Write a program to implement Directory based dynamic hashing technique.
6. Write a program to implement Directoryless dynamic hashing technique.
7. Write a program to insertion and updation in skip lists.
8. Write a program to implement Boyer-Moore algorithm for String matching
9. Write a program to implement Binary Search tree.
10. Write a program to implement AVL tree.
11. Write a program to implement B tree.
12. Write a program to implement Splay tree
13. Write a program to implement Digital search tree.
14. Write a program to implement Binary heap structure.
15. Write a program to implement Leftist heaps.
16. Write a program to implement Boyer-Moore algorithm for String matching.
17. Write a program to implement Knuth-Morris-Pratt algorithm for String matching.
18. Write a program to compress text using Huffman coding algorithm.
19. Write a program to implement Tries to perform pattern matching.

20.Write a program to construct priority search tress.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-113

Subject Name: Advanced Bioinformatics Laboratory

Programme: M.Tech.(IT)	**L:**0 **T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 50	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Fundamentals of Computer Networks and Wireless Sensor Networks,
Additional Material Allowed in ESE: Nil

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Analysis of protein sequence from protein database.
2.	Analysis of Primary, Secondary and Tertiary Structure of Protein.
3.	Implementation of Pair-wise and Multiple Sequence Alignment by using ClustalW.
4.	Phylogenetic analysis by using web tool.
5.	Quaternary structural analysis.

Detailed Contents:

1. Analysis of protein sequence from protein database.
2. Primary structure analysis of protein.
3. Secondary structure analysis of protein.
4. Tertiary structure analysis of protein.
5. Pair-wise sequence alignment by using ClustalW.
6. Multiple sequence alignment by using ClustalW.
7. Phylogenetic analysis by using web tool.
8. Quaternary structural analysis.

Text Books:

1. Rastogi, S.C., Mendiratta, N., Rastogi, P. (2018). *Bioinformatics: Methods and Applications - Genomics, Proteomics and Drug Discovery* (4th ed.). India: PHI Learning.
2. Antao, T. (2015). *Bioinformatics with Python Cookbook* (2nd ed.). Birmingham, UK: PACKT Publishing.
3. Ghosh, Z. and Mallick, B. (2013). *Bioinformatics: Principles and Applications* (4th ed.). UK: Oxford University Press.

Reference Books:

1. Bergeron, B. (2017). *Bioinformatics Computing* (4th ed.). India: Prentice Hall Inc.
2. Ignacimuthu, S. (2013). *Basic Bioinformatics* (3rd ed.). India, New Delhi: Narosa Publishing House Pvt. Ltd.

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E-Books and online learning material

1. An Introduction to Bioinformatics Algorithms by Neil C. Jones and Pavel A. Pevznerhttp://www.cs.ukzn.ac.za/~hughm/bio/docs/IntroToBioinfAlgorithms.pdf Accessed on Dec. 09, 2019
2. Protein Structure Prediction by Sitao Wu and Yang Zhang

https://zhanglab.ccmb.med.umich.edu/papers/2009_8.pdfAccessed on Dec.10, 2019

Online Courses and Video Lectures

1. http://bix.ucsd.edu/bioalgorithms/presentations/Ch08_GraphsDNAseq.pdf Accessed on Dec.10, 2019
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5187414/ Accessed on Dec. 14, 2019
3. https://zhanglab.ccmb.med.umich.edu/papers/2010_2.pdfAccessed on Dec. 13, 2019

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-114

Subject Name: Data Analytics Laboratory

Programme: M.Tech.(IT)	**L:**0 **T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:100%**
External Marks: 50	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Data Mining, Machine Learning, Programming skills in C/C++, Java, Soft Computing.

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Gather sufficient relevant data, conduct data analytics using scientific methods, and make appropriate and powerful connections between quantitative analysis and real-world problems.
2.	Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using data analytics skills to provide constructive guidance in decision making.
3.	Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
4.	Show substantial understanding of the real problems; conduct deep data analytics using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
5.	Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.

Detailed Contents:

1. Downloading and Installing R and R Studio.
2. Installation of relevant R packages.
3. Exploratory data analysis in R.
4. Data Manipulation in R
5. Perform correlation analysis in R.
6. Demonstrate Analysis of variance using R.
7. Implement Chi-Square Test in R.
8. Demonstrate T-test.
9. Predictive Modelling using R.
10. Descriptive Analysis using R.
11. Demonstrate Regression Analysis.
12. Project: Sentiment Analysis using R.

4. Seweryn Spalek, “Data Analytics in Project Management”, 6th Edition, CRC Press – Taylor and Francis Group, 2019.
5. G. James, D. Witten, T Hastie, and R. Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer, 2013.
6. Mark Gardener, “*Beginning R: The Statistical Programming Language*”, Wiley, 2013.
7. Nina Zumel and John Mount, “Practical Data Science with R”, Manning.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-116

Subject Name: Machine Learning – II Laboratory

Programme:M.Tech.(I.T.)	**L:0 T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**70%
External Marks: 50	**Duration of End Semester Exam(ESE):**03 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Programming in Python, Data Mining or Machine Learning or Data Science

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Familiar with tensorflow and colab for implementing Machine Learning Algorithms.
2.	Evaluate the Machine Learning Model using Decision Tree
3.	Implementing and Visualizing Machine Learning Model using Neural Networks
4.	Design genetic algorithm for the specific problem.
5.	Apply the appropriate Machine Learning Model for the problem under consideration

Detailed Contents:

1. Overview of Tensorflow.
2. Get Started with Google Colab.
3. Machine Learning Model using MNIST Dataset. This involves training and testing data.
4. Build Neural Network with Tensorflow in Colab.
5. Utilizing Neural Network Playground to visualizing Machine Learning Algorithms.
6. Classification and Regression Tree (CART) as Decision Tree Classifier.
7. To test CART and calculate the Accuracy/Precision.
8. Implementing Genetic Algorithm for the specific Optimization Problem.
9. Implementing Hybrid Genetic Algorithm for the specific Optimization Problem.

Project: Student will develop the individual projects that include building the Machine Learning Model addressing the issues faced in different areas.

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-117

Subject Name: Parallel and Distributed Computing Laboratory.

Programme: M.Tech.(IT)	**L:**0**T:** 0 **P:** 2
Semester:2	**Teaching Hours:**24 Hours
Theory/Practical: Theory	**Credits:**01
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 50	**Duration of End Semester Exam (ESE):**03 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Good programming skills

PARALLEL AND DISTRIBUTED COMPUTING Laboratory

With the help of CUDA programming using parallel and distributed programming techniques implement algorithms for

Searching and Sorting

Matrix operations: Matrix-Vector Multiplication, Matrix-Matrix Multiplication

Graph algorithms: Minimum Spanning Tree, Single-Source Shortest Paths

Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search

Mini project: Students are required to apply parallel programming using CUDA for improving algorithms related to:

Fast Video Transcoding

Video Enhancement

Oil and Natural Resource Exploration

Medical Imaging

Computational Sciences

Neural Networks

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-118

Subject Name: Components and Applications of IoT Laboratory

Programme: M.Tech.(IT)	**L:**0 **T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 50	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Fundamentals of Computer Networks, Wireless Sensor Network, Communication and Internet Technology, Web Technology, Information Security

Additional Material Allowed in ESE: Nil

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Implementation of Raspberry Pi using NOOBS to set up Raspberry Pi SD Card.
2.	Learn to connect Raspberry Pi to the Internet via the LAN Connector and USB WiFi dongle.
3.	Familiarity to connect Internet through proxy server.
4.	Connect remotely to the Raspberry Pi over the network using VNC and SSH.
5.	Design and implement an IoT based project.

Detailed Contents:

1. Connecting the Raspberry Pi using NOOBS to set up Raspberry Pi SD Card
2. Connect Raspberry Pi to the Internet via the LAN Connector
3. Configuring the network directly to the laptop or computer
4. Connect Raspberry Pi to the Internet via the USB WiFi dongle
5. Connecting to the Internet through proxy server
6. Connecting remotely to the Raspberry Pi over the network using VNC
7. Connecting remotely to the Raspberry Pi over the network using SSH (and X11 forwarding)
8. Sharing the home folder of the Raspberry Pi with SMB
9. Keeping the Raspberry Pi upto date
10. Minor Project:The students should build some IoT project(s).

Text Books:

1. CunoPfister, “Getting started with the Internet of Things”, O’Reilly Media, 2011.
2. ArshdeepBahga and Vijay Madisetti, “Internet of Things – A Hands-on approach”, University press, 2015.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable approach of connecting everything”, Apress Publications, 2013.

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Reference Books:

1. M. Richardson and S. Wallace, "*Getting started with Raspberry Pi*", O'Reilly (SPD), 2014.
2. R.L. Krutz and R.D. Vines, "*Cloud Security: A Comprehensive Guide to Secure Cloud Computing*", Wiley-India, 2010.

E-Books and online learning material

1. IoT Design Principles by George Cora and David Mohr.https://www.slideshare.net/ardexateam/iot-design-principles-79806278 Accessed on Dec. 09, 2019

2. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally. https://madsg.com/wp-content/uploads/2015/12/Designing_the_Internet_of_Things.pdf Accessed on Dec. 15, 2019

Online Courses and Video Lectures

1. https://www.futurice.com/blog/7-design-principles-for-iot Accessed on Dec.10, 2019
2. https://www.seebo.com/iot-design/ Accessed on Dec. 14, 2019
3. https://www.kdnuggets.com/2017/01/internet-of-things-tutorial-chapter-2-wsn-rfid-forerunners.html Accessed on Dec. 13, 2019

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M.Tech.(IT)

2019 Admission Batch Onwards

Subject Code: LMIT-115

Subject Name: Social Networking Laboratory

Programme: M.Tech.(IT)	**L:**0 **T:**0 **P:**2
Semester: 2	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:1**00%
External Marks: 50	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Basics of R, Data Mining, Recommender Systems.

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Apply the basic function of loading, managing and visualizing the networks.
2.	Demonstrate the development of social network structures through basic cohesion metrics.
3.	Implement the framework of network analysis.
4.	Apply the concept of network centrality with various concepts like betweenness, closeness, page ranks etc.
5.	Implement various community concepts like: clustering, community structure, modularity

Detailed Contents:

1. Install all packages need for Social Network Analysis in R.
2. Addition, Visualization and Export of Vertex Attributes of a Graph.
3. Acquisition of basic cohesion metrics of density, reciprocity, reach, path distance, and transitivity.
4. Develop triadic analyses and a measure of heterogeneity.
5. Calculation of Centrality Measures.
6. Find the correlations between different Centrality measures.
7. Community detection based on betweenness method.
8. Hierarchical Clustering On Social & Task Ties.
9. Case Studies on social network analysis for different social networks such as Facebook, Twitter, LinkedIn etc.

Reference Books:

1. John Scott, Social Network Analysis, 3rd Edition, SAGE Publications, 2012.
2. Song Yang, Franzisca B.Kellar, Lu Zheng, Social Network Analysis: Methods and Examples, SAGE Publications, 2017.
3. Wouter de Nooy, Andrej Mrvar, Vladimir Batagelj, Exploratory Social Network Analysis with Pajek, 2nd Revised Edition, Cambridge University Press, 2011.
4. Patrick Doreian, Frans Stokman, Evolution of Social Networks, Routledge, 2013.
5. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.