OBJECTIVES OF THE COURSE:

- To learn the art of Literature Review and to focus on a research problem using scientific methods.
- To inculcate analytical thinking and data interpretation capability.
- To enable to apply the fundamental laws of performance analysis to establish the relationships between workload parameters and system performance for a given system.
- To learn how to synthesize and communicate research findings to a wide range of audiences.

Sessional Marks: 40
Exam Marks: 60

UNIT-I  
Formulating Research Problem and Conceptualizing a Research Design:  
Meaning of research problem, Sources of research problem, Criteria/Characteristics of a good research problem, Scope and objectives of research problem. Reviewing the literature, formulating a research problem, identifying variables, constructing hypotheses, Errors in selecting a research problem.
Research design: Objectives, Strategies, Guidelines for design of experiments. Selecting a study design.

UNIT-II  
Research Modeling: Types of Models, Model building and stages, Data consideration and testing Heuristic and Simulation modeling.  
Mathematical Modeling and Simulation: Important of modeling and simulation, Continuous and discrete models and simulation, Model validation, verification and credibility.  
Modeling Principles: Fundamental laws, Monte Carlo simulation, stochastic state transition systems.

UNIT-III  
Research Tools: Tools needed for Editing, Presentation, Data Analysis and visualization, Simulation and Modeling. Analysis, Design and Simulation tools related to specialization.  
Searching: Using advanced search technique for searching research materials in online repositories/consortium, like inflibnet, Indest, Scopus, etc.
UNIT-IV  

**Developing a Research Proposal:** Format of research proposal, Individual research proposal. Institutional proposal, Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only.


**Plagiarism:** Introduction of Plagiarism, Dimension of Plagiarism, Detect Plagiarism, Strategies to Minimize Plagiarism.

**Recommended Textbooks:**

2. “Research Methodology: A Step by Step Guide for Beginners”, 2/e, by Ranjit Kumar (2005), Pearson India
UNIT I  FUNDAMENTALS

UNIT II  DATA PREPROCESSING AND ASSOCIATION RULES

UNIT III  PREDICTIVE MODELING
Classification and Prediction Issues Regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods – Prediction – Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

UNIT IV  DATA WAREHOUSING

TEXT BOOK:
1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

REFERENCES:
Name of student: Mr. Khalid Anwar
Name of Supervisor(s): Prof. Jamshed Siddiqui

DEPARTMENT OF COMPUTER SCIENCE
ALIGARH MUSLIM UNIVERSITY
ALIGARH, U.P.- 202002

SYLLABUS COURSEWORK- Ph.D. in Computer Science
PAPER–II (COURSE TITLE: DATA MINING)

Sessional Test: 40
Final Exams: 60

UNIT I  
FUNDAMENTALS

UNIT II  
DATA PREPROCESSING AND ASSOCIATION RULES

UNIT III  
PREDICTIVE MODELING
Classification and Prediction Issues Regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods – Prediction – Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

UNIT IV  
DATA WAREHOUSING

TEXT BOOK:
1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

REFERENCES:
UNIT I  FUNDAMENTALS

UNIT II  DATA PREPROCESSING AND ASSOCIATION RULES

UNIT III  PREDICTIVE MODELING
Classification and Prediction Issues Regarding Classification and Prediction –Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods– Prediction –Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

UNIT IV  DATA WAREHOUSING

TEXT BOOK:
1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

REFERENCES:
UNIT I  SCALABILITY AND CLUSTERING

UNIT II  ENABLING TECHNOLOGIES

UNIT III  SYSTEM INTERCONNECTS
Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.

UNIT IV  PARALLEL PROGRAMMING

TEXT BOOK:

REFERENCES:
PAPER–II (COURSE TITLE: The Study on Load Balancing Issues to optimize Quality of Services (QoS) parameters in Cloud Computing)

Sessional Test: 40
Final Exam: 60


UNIT-II: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud-based services. Economics of choosing a Cloud platform for an organization, based on application requirement, economic constraints and business needs (e.g. Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Red hat).


Books & References:

Name of Student: Mr. Mohd. Anas Wajid  
Name of Supervisor(s): Dr. Aasim Zafar

DEPARTMENT OF COMPUTER SCIENCE  
ALIGARH MUSLIM UNIVERSITY  
ALIGARH, U.P.-202002

SYLLABUS COURSEWORK – Ph.D. in Computer Science  
PAPER–II (COURSE TITLE: SOFT COMPUTING)

Sessional Marks: 40  
Exam Marks: 60

OBJECTIVE OF THE COURSE:


Recommended Textbooks:


7. **The Elements of Statistical Learning**, Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman (2008), Springer.


**Web References:**


2. “**NPTEL: Deep Learning**”, https://onlinecourses.nptel.ac.in/noc18_cs41/


4. “**NPTEL: Introduction to Soft Computing**”, https://onlinecourses.nptel.ac.in/noc18cs13/ preview

5. “**NPTEL: Introduction to Artificial Neural Networks**”, https://nptel.ac.in/courses/ 117105084/
OBJECTIVE OF THE COURSE:


Recommended Textbooks:

7. **The Elements of Statistical Learning**, Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman (2008), Springer.

**Web References:**

2. “NPTEL: Deep Learning”, [https://onlinecourses.nptel.ac.in/noc18_cs41/](https://onlinecourses.nptel.ac.in/noc18_cs41/)
4. “NPTEL: Introduction to Soft Computing”, [https://onlinecourses.nptel.ac.in/noc18cs13/ preview](https://onlinecourses.nptel.ac.in/noc18cs13/)
5. “NPTEL: Introduction to Artificial Neural Networks”, [https://nptel.ac.in/courses/117105084/](https://nptel.ac.in/courses/117105084/)
DEPARTMENT OF COMPUTER SCIENCE
ALIGARH MUSLIM UNIVERSITY
ALIGARH, U.P.-202002

SYLLABUS COURSEWORK – Ph.D. in Computer Science
PAPER-II (COURSE TITLE: SOFT COMPUTING)

Sessional Marks: 40
Exam Marks: 60

OBJECTIVE OF THE COURSE:


Recommended Textbooks:

7. **The Elements of Statistical Learning**, Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman (2008), Springer.

**Web References:**

5. “NPTEL: Introduction to Artificial Neural Networks”, https://nptel.ac.in/courses/ 117105084/
Name of Student: Mr. Shadab Alam Siddiqui  
Name of Supervisor: Dr. Tamanna Siddiqui

DEPARTMENT OF COMPUTER SCIENCE  
ALIGARH MUSLIM UNIVERSITY  
ALIGARH, U.P.-202002 (INDIA)

SYLLABUS: COURSEWORK – Ph.D. in Computer Science

PAPER–II (COURSE TITLE: Design of Testing Framework For Container Based Applications)

Final Exam: 60  
Sessional Test: 40

UNIT – I  

UNIT – II  
Overview of Test Execution Process; Challenges in Test Execution; Methods of Test Execution; Test Coverage & Test Environment & Analysis & Use of Test Results. Requirements for A Test Tool; Defect Tracking Tools; Functional Testing Tools; Performance Testing Tools; Unit Testing Tools; Test Automation Tools; Scope of Automation; Need For Automation; Design & Architecture Framework For Automation; Manual Vs Automation Testing; Factors Determining Test Automation; Approaches To Automation; Challenges in Software Test Automation; Different Test Automation Tools.

UNIT – III  
Testing in the Cloud, Testing container-based applications, On-Demand test environment construction, non-functional testing, non-functional testing of container applications, Facts of Cloud and container-based Software Testing, Container testing that’s practiced within the industry, cloud and container testing methods, issues and challenges of container testing, testing as a service.
UNIT – IV

Literature Review: Study on social media and different types of activities on social media. A review of text mining techniques. Review of different types of text Mining algorithms. Survey on data mining tools Survey on clustering, review on clustering tools, Review of different frameworks for text analysis, study of tools used in social media analysis.

Books & References:

2. George Reese, Cloud Application Architectures, O’Rielly Media Inc, 2009
8. Containers Beyond The Hype, Dinesh Subhareti, 2015
UNIT-I
Data Mining definition and Task, KDD versus Data Mining, Data Mining techniques, tools and application, Text Mining definition, Text Mining techniques, Applications of Text Mining, Text Mining Processing, Text Mining vs Data Mining, The nature of unstructured and semi-structured text. Text Classification, Big Data definition, Big Data techniques, Applications of Big Data, Big Data analysis, Unstructured Data.

UNIT-II
Natural language processing, basic techniques in natural language processing, including tokenization, part-of-speech tagging, chunking, syntax parsing and named entity recognition, Machine Language algorithms. Document representation, basic supervised text categorization algorithms, including Naïve Bayes, k Nearest Neighbor (kNN), Text clustering, connectivity-based clustering (a.k.a., hierarchical clustering) and centroid-based clustering (e.g., k-means clustering). Document summarization, Extraction based summarization methods.

UNIT-III
Social media and network analysis, unique characteristic of social network: inter-connectivity, Google’s winning algorithm PageRank. Social influence analysis and social media analysis, task of extracting subjective information in source material, sentiment analysis: sentiment polarity prediction, review mining, and aspect identification.

UNIT-IV
Books & References:


UNIT-I  Introduction to Information Security and Number theory
What is Information Security, Need of Information Security; Security Architecture Data Security; Security Goals: Confidentiality, Integrity, Availability; Attacks on Security; Active vs. Passive Attacks; Authentication; Access Control; Non-Repudiation; Steganography; Basics of Cryptography; Cryptanalysis; Digital signatures; Public-key cryptography; Cryptographic Hash functions.

Mathematical induction, Binomial Number theorem, Elementary Number Theory, Integer Arithmetic, Modular Arithmetic, Factorization, Exponentiation and Logarithm, Primes, Matrices, Groups, Rings, Fields, Finite Fields; Cryptography background;

UNIT-II  Cryptographic techniques and Cryptanalysis
Symmetric Cryptography, Data Encryption Standard (DES), Triple-DES, the Advanced Encryption Standard (AES), International Data Encryption Algorithm (IDEA), Blowfish, RC4, RC5, RC6, Asymmetric Cryptography, The Diffie-Hellman Algorithm, RSA, Elliptic Curve Cryptosystems (ECC)

UNIT-III  Latest Security Technologies
SDN (Software-defined Networking), Virtual Dispersive Networking (VDN), Smart Grid Technologies, SAML & The Cloud, Distributed Ledger Technology principles, Blockchain, Advanced analytics, Context-Aware Behavioral Analytics, Deep learning, Gartner’s CARTA approach, Bioprinting, Mobile Location Tracking, Behavioral Profiles, Third-Party Big Data, External Threat Intelligence, Tailor-made security, Early Warning Systems, Hardware authentication.

UNIT-IV  Security in Cloud and Distributed Systems
The cloud computing and distributed systems concepts and models: virtualization, cloud storage: key-value/NoSQL stores, cloud networking, Consensus in Cloud Computing, FLP proof, fault-tolerance in cloud using PAXOS, peer-to-peer systems, classical distributed algorithms, leader election, time, ordering in distributed systems, distributed mutual exclusion, distributed algorithms for failures and recovery approaches, Security As a Service, Distributed Ledger Technology principles, Blockchain, Apache Spark, Google’s Chubby, Apache Zookeeper, HBase, MapReduce, Apache Cassandra, Google’s B4, Microsoft’s Swan.
Recommended Textbooks:

2. “A Course in number theory and cryptography” by Neal Koblitz, Springer-Verlag Publication
3. “Cryptography & Network Security” 1/e by Behrouz Forouzan, Tata McGraw-Hill,
8. “Big Data Analytics in Cybersecurity (Data Analytics Applications)” by Onur Savas (Editor), Julia Deng (Editor)

References:

1. “Applied Cryptography” 2/e by Bruce Schneier, JohnWllley and Sons Inc, 2008
10. https://www.ecpi.edu/blog/new-cybersecurity-technologies-what-is-shaking-up-the-field
UNIT-I  Introduction to Information Security and Number theory
What is Information Security, Need of Information Security; Security Architecture Data Security; Security Goals: Confidentiality, Integrity, Availability; Attacks on Security; Active vs. Passive Attacks; Authentication; Access Control; Non-Repudiation; Steganography; Basics of Cryptography; Cryptanalysis; Digital signatures; Public-key cryptography; Cryptographic Hash functions.

Mathematical induction, Binomial Number theorem, Elementary Number Theory, Integer Arithmetic, Modular Arithmetic, Factorization, Exponentiation and Logarithm, Primes, Matrices, Groups, Rings, Fields, Finite Fields; Cryptography background;

UNIT-II  Cryptographic techniques and Cryptanalysis
Symmetric Cryptography, Data Encryption Standard (DES), Triple-DES, the Advanced Encryption Standard (AES), International Data Encryption Algorithm (IDEA), Blowfish, RC4, RC5, RC6, Asymmetric Cryptography, The Diffie-Hellman Algorithm, RSA, Elliptic Curve Cryptosystems (ECC)

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SDN (Software-defined Networking), Virtual Dispersive Networking (VDN), Smart Grid Technologies, SAML & The Cloud, Distributed Ledger Technology principles, Blockchain, Advanced analytics, Context-Aware Behavioral Analytics, Deep learning, Gartner’s CARTA approach, Bioprinting, Mobile Location Tracking, Behavioral Profiles, Third-Party Big Data, External Threat Intelligence, Tailor-made security, Early Warning Systems, Hardware authentication.

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The cloud computing and distributed systems concepts and models: virtualization, cloud storage: key-value/NoSQL stores, cloud networking, Consensus in Cloud Computing, FLP proof, fault-tolerance in cloud using PAXOS, peer-to-peer systems, classical distributed algorithms, leader election, time, ordering in distributed systems, distributed mutual exclusion, distributed algorithms for failures and recovery approaches, Security As a Service, Distributed Ledger Technology principles, Blockchain, Apache Spark, Google’s Chubby, Apache Zookeeper, HBase, MapReduce, Apache Cassandra, Google’s B4, Microsoft’s Swan.
Recommended Textbooks:

2. “A Course in number theory and cryptography” by Neal Koblitz, Springer-Verlag Publication
3. “Cryptography & Network Security” 1/e by Behrouz Forouzan, Tata McGraw-Hill,
8. “Big Data Analytics in Cybersecurity (Data Analytics Applications)” by Onur Savas (Editor), Julia Deng (Editor)

References:

1. “Applied Cryptography” 2/e by Bruce Schneier, JohnWillley and Sons Inc, 2008
10. https://www.ecpi.edu/blog/new-cybersecurity-technologies-what-is-shaking-up-the-field
UNIT-I  Internet of Things

Internet of Things: Definition and characteristics of IoT, concepts behind the Internet of Things. Internet of Everything, industrial IoT, smartness in IoT, IoT paradigm, smart objects;
Reference Architecture: IoT architecture, reference model and architecture, IoT reference model, IoT reference architecture, functional view, information view, deployment and operational view, other relevant architectural views; Communication Technologies and Protocols: RFID, NFC, WSN, IEEE 802.11, IEEE 802.15), Bluetooth, Zigbee, 6LOWPAN, 6TiSCH, COAP, MQTT, RPL; Internet of Things Applications: Intelligent transportation, smart clothing, smart grids, education, environment observation, forecasting and protection, smart agriculture and farming, health care, smart homes/buildings and monitoring, public safety, smart cities.

UNIT-II  Wireless Sensor Network WSN

Wireless Sensor Network: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for WSNs, Why are sensor networks different, Enabling technologies for wireless sensor networks; Hardware Components: Sensor node hardware overview, Controller, Memory, Communication device, Sensors and actuators, Power supply of sensor nodes, some examples of sensor nodes; Network Architecture Sensor network scenarios: Types of sources and sinks, Single-hop versus multichip networks, multiple sinks and sources, three types of mobility; Optimization Goals and figures Of Merit: Quality of service (QoS), Energy efficiency, Scalability, Robustness.
UNIT-III  Software Defined Network

History and Evolution of Software Defined Networking (SDN): Separation of Control Plane and Data Plane, Active Networking; Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the OpenFlow protocol; Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects; Data Plane: Software-based and Hardware-based; Programmable Network Hardware; Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others); Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT-IV  IoT Enabling Technologies


Recommended Textbooks:

3. Fatima Hussain “Internet of Things Building Blocks and Business Models” SpringerBriefs in Electrical and Computer Engineering, (eBook) DOI 10.1007/978-3-319-55405-1

References:

Name of student: Afreen Khan  
Name of Supervisor: Dr. Swaleha Zubair  

DEPARTMENT OF COMPUTER SCIENCE  
ALIGARH MUSLIM UNIVERSITY  
ALIGARH, U.P.-202002  

SYLLABUS: COURSEWORK- Ph.D. in Computer Science  
PAPER–II (COURSE TITLE: MACHINE LEARNING)  

Sessional Test: 40  
Final Exam: 60  

Unit 1. Introduction to machine learning and different types of learning:  
Overview of Machine Learning; Definition, Components of a learning problem, Applications,  
Choosing a Model Representation, Types of learning: Supervised Learning, Unsupervised  
Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction,  

Unit 2. Linear Regression and Decision Trees, Instance based learning and Feature  
Selection:  
Regression, Types of Regression Models, LMS Algorithm, Decision Tree, Overfitting, Instance- 
Based Learning, Basic k-nearest neighbor classification, kNN, Euclidean Distance, Feature  
Reduction in ML, Subset selection, Feature extraction, PCA  

Unit 3. Probability and Bayes Learning, Support Vector Machines, Clustering:  
Probability for Learning, Bayes Theorem, MAP Learner, Naïve Bayes, Bayesian Network,  
Logistic Regression for classification, Support Vector Machines, Unsupervised learning,  
Partitioning Algorithms, Hierarchical Clustering, Density based Clustering, K-means algorithm  

Unit 4. Neural Network:  
Neuron, ANNs, Perceptrons, Gradient Descent, Backpropagation, Deep Learning, Deep Neural  
Network, Hierarchical Representation, Unsupervised Pre-training, Activation Functions  

REFERENCES:  
Name of Student: Ghazala Sultan  
Name of Supervisor(s): Dr. Swaleha Zubair  

DEPARTMENT OF COMPUTER SCIENCE  
ALIGARH MUSLIM UNIVERSITY  
ALIGARH, U.P.-202002  

SYLLABUS COURSEWORK – Ph.D. in Computer Science  
PAPER–II (COURSE TITLE: Advance Concept in Bioinformatics)  

Sessional Marks: 40  
Exam Marks: 60  

OBJECTIVE OF THE COURSE:  

- To learn basic concepts related to bioinformatics, understanding biological databases, exploring bioinformatics tools for analyzing biological data to find mutation in genes and their implication in diseases.

UNIT-I  
Introduction to Bioinformatics: Bioinformatics: What and why, Goal, Scope and Limitations, Applications of bioinformatics: Gene therapy, Drug development, personalized medicine, biotechnology, Evolutionary studies, Central Dogma of cell, Understanding Genomics Bioinformatics, Basic glossary of bioinformatics, bioinformatics tools.

UNIT-III  
Understanding Biological Databases: Definition, Classification of Databases, Biological Databases: Nucleic acid sequence databases, protein sequence databases, Genome Databases, Other Databases of Patterns/Motifs/System Biology, Pitfalls of Biological Databases, Biological data formats, Information Retrieval from Biological Databases, Gene Prediction, Genome Annotation, Biological Functional Annotation, Genome Visualization.

UNIT-III  
Sequence Analysis and Alignment: Sequence Analysis: Various file formats for bio-molecular sequences: genbank, fasta, gcg, msf, etc, Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues, Sequence-based Database Searches, BLAST and FASTA algorithms, various versions of basic BLAST and FASTA. Sequence Alignment: Substitution matrices, Scoring matrices – PAM and BLOSUM. Local and Global alignment concepts, Dot plot, Multiple sequence alignment, Progressive alignment, Pairwise alignment, Gaps.
UNIT-IV  **Next Generation Sequencing (NGS) - RNASeq Data Analysis:** Overview of NGS & detailed understanding, Data Retrieval & Introduction to data types Read Quality Check, Alignment of reads using reference Genome, Visualization of mapped reads (UCSC / IGV), expression analysis, Different plots (Heatmap, volcano plot etc), Pathway & Gene ontology enrichment analysis, Pathway Network Analysis, Linking genes and disease.

**Recommended Textbooks:**


Unit 1. Introduction to machine learning and deep learning and different types of learning

Overview of Machine Learning; Definition, Components of a learning problem, Application Choosing a Model Representation, Types of learning; Supervised Learning, Unsupervised Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction Multilayer Perceptron (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks

Unit 2. Linear Regression and Decision Trees, Instance based learning and Feature Selection:

Regression, Types of Regression Models; Decision Tree, Elman, Jordan, Convolutional, Recurrent and Recursive Neural Network, Restricted Boltzmann Machine-Deep Belief Networks, Recurrent Neural Network with word embedding-Modeling and Generating Sequence.

Unit 3. Deep Learning Methods

Linear Factor Models, Autoencoders, De-noising Autoencoders, Stacked Autoencoders, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis

Unit 4. Overview of Languages and tools: Python, R Programming, Tensorflow, Matlab

References

1. B.-D. S. Shalev-Shwartz S. Understanding machine learning: From theory to algorithms. Cambridge, 2014
Name of Student: Mr. Muaadh Abdo Al Sabri
Name of Supervisor: Dr. Swaleha Zubair

DEPARTMENT OF COMPUTER SCIENCE
ALIGARH MUSLIM UNIVERSITY
ALIGARH, U.P.-202002 (INDIA)

SYLLABUS: COURSEWORK- Ph. D in Computer Science

PAPER–II (COURSE TITLE: DATA MINING)

Sessional Test: 40
Final Exam: 60

Unit–I
Motivation-Steps in Data Mining, Architecture-Data Mining and Databases, Data Warehouses, Data Mining functionalities–Classification–Data Mining Primitives– Major issues. Data Processing: An overview, data cleaning, data integration, data reduction, data transformation and data discretization,

Unit–II
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, classification by backpropagation, support vector machines, associative classification, lazy learners and other classification methods. Cluster Analysis: basic concepts of cluster analysis.

Unit–III

Unit–IV
Exploring the Big Data Stack, Virtualization and Big Data, Virtualization Approaches. Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Non-Relational Database, Integrating Big Data with Traditional Data Warehouses, Big Data Analysis and Data Warehouse, Analytical Approaches and Tools to Analyze Data

References
1. Sumathi, S.N. Sivanandam, Introduction to Data Mining and its Applications
2. Arun K Pujari, Data Mining Techniques


References:
2. “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” By Tim Mather.
UNIT-I  Data Mining Basics
Background : research and evolution, Process: Pre-processing, Data mining, Results validation, Data Mining: Classification Schemes, General functionality: Descriptive data mining, Predictive data mining, Different views, different classifications: Kinds of databases to be mined, Kinds of knowledge to be discovered, Applications: Spatial data mining, Temporal data mining, visual data mining etc.

UNIT-II  Data Mining with Fuzzy Methods

UNIT-III  Information Retrieval Systems Architecture
Web search engine architecture: crawler based and metasearch technologies, News search engine architecture: news metasearch technology, Meta search engine components: search engine selection, wrapper generation, publication time extraction, Result merging strategies.

UNIT-IV  IR Evaluation Techniques and Measures
Model types: First dimensional mathematical basis, Second dimensional properties of the model, performance and correctness measures: precision, recall, Fall-out, F-measure, average precision, mean average precision, discounted cumulative gain, timeline, Time-sensitive measures.

Recommended Textbooks:
1. “Introduction to Information Retrieval” by Christopher D. Manning, Hinrich Schütze, and Prabhakar Raghavan
2. “Data Mining: Concepts and Techniques”, By Jiawei rlan and Micheline Kamber

References:


UNIT I  **Object Oriented Design**  

UNIT II **Software Cost Estimation**  
Objectives, Software cost components, Costing and pricing, Productivity estimates, Estimation techniques, Estimation methods, COCOMO model, COCOMO Cost Drivers, Function Point Analysis (FPA), CMMI.

UNIT III **Estimation of Project effort**  
Estimation for Software Projects: Estimation of Project Cost and Effort: Estimation of Project Cost and Effort, Project Estimation Approaches, Problem-Based Estimation, Process-Based Estimation

UNIT IV **Software maintenance:**  
Definition and scope, Types of maintenance, software maintenance issues, Organize for maintenance, IEEE maintenance standard, maintenance metrics, Maintainability Estimation Model for Object-Oriented Software in Design Phase, Maintainability Estimation Model and Metrics for Object-Oriented Design, Appreciate the cost of maintenance

**REFERENCE BOOKS:**

1. I. Sommerville  
   Software Engineering. Addison-Wesley: Harlow, UK, 1996
2. Penny Grubb  
   Software maintenance: Concepts and Practices
3. Gopalaswamy Ramesh  
   Software maintenance
4. Barry W. Boehm  
   Software Cost Estimation with Cocomo II

**REFERENCE:**


UNIT-II: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirement, economic constraints and business needs (e.g. Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat).


Books & References:

UNIT-I  **E-learning**- Definition and scope, Approaches to E-learning services, Computer-based learning, Computer-based training, Computer-supported collaborative learning (CSCL), Technology-enhanced learning (TEL), Adaptive E-Learning, cognitive learning Technology issues- Communication technologies used in E-learning, Learning Management System (LMS), Learning Content Management system (LCMS), Computer-aided assessment, Electronic Performance Support Systems (EPSS)


UNIT-III **Dimensions of e-learning**- Pedagogical, Technological, Interface, Evaluation, resource support, Ethical, Institutional

UNIT-IV Feedback- Overview, Types of Feedback, Levels of Feedback in e-learning, Feedback representation, Time of feedback presentation, Impact of feedback on students’ learning

**REFERENCE BOOKS**

1. Bryn Holmes, John E-learning: concepts and practice, 20069+0 Gardner
2. Grainne Conole Contemporary perspectives in E-learning research
4. Ruth C. Clark e-Learning and the Science of Instruction

**REFERENCE**


SYLLABUS: COURSEWORK - Ph.D. in Computer Science
COURSE: Cryptography & Network Security

SESSIONAL MARKS: 40
EXAMINATION MARKS: 60

UNIT-I Some Preliminary Mathematical Background
Mathematical induction, Binomial Number theorem, Elementary Number Theory, Integer
Arithmetic, Modular Arithmetic, Factorization, Exponentiation and Logarithm, Primes,
Matrices, Groups, Rings, Fields, Finite Fields.

UNIT-II Basics of Cryptography
Data Security; Security Goals: Confidentiality, Integrity, Availability; Atttacks on Security;
Active vs. Passive Attacks; Authentication; Access Control; Non Repudiation;
Steganography; Basics of Cryptography; Cryptanalysis; Digital signatures; Public-key
cryptography; Hash functions; DES; AES

UNIT-III Symmetric Key Cipher
Introduction; Substitution Cipher (Monoalphabetic Cipher, Polyalphabetic Cipher);
Transposition Cipher; The one time pad: Vernam’s cryptosystem; Perfect secrecy; Stream
Ciphers; Block Ciphers; S-Boxes
Stream Cipher: Synchronous stream ciphers; self-synchronizing or asynchronous stream
cipher; Light Weight Stream Cipher. Ultra Light Weight Stream Cipher Linear Feedback
shift registers; nonlinear feedback shift registers; Stream Ciphers based on LFSRs;
Software Based Stream Cipher, Use of Stream Ciphers.

UNIT-IV Cryptanalysis and Attacks
Cryptanalysis: Linear cryptanalysis, Differential Cryptanalysis, Algebraic Cryptanalysis,
Attacks: Linear Attacks; Algebraic Attacks; Structural attacks, Brute Force Attack,
Resynchronization attack; Structure of Some Stream Cipher e.g. Sober Family of Stream
Ciphers, HC family of Stream Ciphers, Py family of stream ciphers

Recommended Textbooks:

2. “A Course in number theory and cryptography” by Neal Koblilz, Springer-Verlag Publication
3. “Cryptography & Network Security” 1/e by Behrouz Forouzan, Tata McGraw-Hill,
4. “Handbook of Applied Cryptography” 1/e by A. Menezes, P. van Oorschot, and S. Vanstone,
   CRC Press, 1996.
5. “Cryptography and Network Security” 4/e by William Stallings, Pearson Education India,
   2008
6. “Understanding Cryptography” 1/e by Christof Paar & Jan Pelzl, Springer Heidelberg Dordrecht
   London New York, 2010
References:

6. “Cryptography Engineering: Design Principles and Practical Applications” by Niels Ferguson, Bruce Schneier, Tadayoshi Kohno Wiley Publication
7. “Practical Cryptography” by Niels Ferguson, Bruce Schneier Wiley Publication
11. http://www.ecrypt.eu.org/
Name of Student: Mr. Ausaf Ahmad  
Name of Supervisor: Dr. Tamanna Siddiqui  

DEPARTMENT OF COMPUTER SCIENCE  
ALIGARH MUSLIM UNIVERSITY  
ALIGARH, U.P.-202002 (INDIA)  

SYLLABUS: COURSEWORK- Ph.D in Computer Science  
Paper-II: Mining Software Repositories for Software Metrics

UNIT-I  

UNIT-II  

UNIT-III  

UNIT IV  
Books & References:


Name of Student: Mr. Parvej Aalam
Name of Supervisor: Dr. Tamanna Siddiqui

DEPARTMENT OF COMPUTER SCIENCE
ALIGARH MUSLIM UNIVERSITY
ALIGARH, U.P.-202002 (INDIA)

SYLLABUS: COURSEWORK- Ph. D in Computer Science
Paper II- Designing Effective Framework for Short Text Clustering

Sessional Test: 40
Final Exam: 60

UNIT-I

UNIT-II
Clustering: Features of good Clustering; Types of Clustering; Different Clustering Methods- Hierarchical Clustering Methods: Agglomerative, Divisive; Some Hierarchical Clustering Algorithms as Basic Agglomerative Hierarchical Clustering Algorithm, Minimum Spanning Tree(MST), Divisive Hierarchical Clustering Algorithm, BIRCH (Balanced Iterative Reducing and Clustering using Hierarchies) Algorithm, CURE(Clustering Using Representatives) Algorithm; Partitioning clustering Algorithms: K-means Algorithm, DBSCAN Algorithm, C-means Algorithm, Fuzzy C-means Algorithm, EM Algorithm; Application of Clustering in various fields as Biology, Education, Medicine, Business etc.

UNIT-III
Short Text Clustering: Definition of Short Text Clustering; Short Text Definition with examples; Clustering Vs. Short Text Clustering; Importance of Clustering Short Text Data; Various Issues in Short Text Clustering: Sparse Feature Vector, Polysemy, Synonymy; Feature Vector and its Calculation; Various methods used for clustering Short Text Data as Wikipedia Method, Word Net Method, Concept Graph Method etc.

UNIT IV
Books & References:


Name of Student: Mr. Riaz Ahmad
Name of Supervisor: Dr. Tamanna Siddiqui

DEPARTMENT OF COMPUTER SCIENCE
ALIGARH MUSLIM UNIVERSITY
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SYLLABUS: COURSEWORK- Ph.D. in Computer Science
Paper-II: Designing an Effective Testing Framework for Cloud Application

Sessional Test: 40
Final Exam: 60

UNIT-I

UNIT-II
Overview Of Test Execution Process; Challenges In Test Execution; Test Entry & Exit Criteria; Methods Of Test Execution; Test Coverage & Test Environment & Analysis & Use Of Test Results. Requirements For A Test Tool; Defect Tracking Tools; Functional Testing Tools; Performance Testing Tools; Unit Testing Tools; Test Automation Tools; Scope Of Automation; Need For Automation; Design & Architecture Framework For Automation; Manual Vs Automation Testing; Factors Determining Test Automation; Approaches To Automation; Challenges In Software Test Automation; Different Test Automation Tools.

UNIT-III
Testing in the Cloud - SMART-T: Migrating Testing to the Cloud, HadoopUnit: Test Execution in the Cloud. On-demand test environment construction, Scalability and performance testing, testing security and measurement in clouds, Large-scale simulation. Facts of Cloud-Based Software Testing, Cloud testing that's practiced within the industry, cloud testing methods, issues and challenges of cloud testing, testing as a service.

UNIT-IV:
Books & References:


Sessional Test:  40  
Final Exam:  60

Unit 1: Introduction – Concepts behind the Internet of Things
IoT definition, advantages, and impact, essential components of IoT (Introduction of IoT devices and discussion on the difference among IoT devices, computers, and embedded devices). The IoT paradigm: Smart objects sensors and actuators in IoT (accelerometer, photo resistor, buttons, motor, LED, vibrator, analog signal vs. digital signal), Bits and atoms, Goal orientation.

UNIT 2: Technologies behind the Internet of Things
Convergence of technologies. RFID + NFC, Wireless networks + WSN, RTLS + GPS, Agents + Multi agent systems. IoT architecture, component and technology (Device, networking, cloud computing and big data analysis). IoT challenges (computation and communication constraints, power constraints, maintenance cost, reliability, data trustworthiness, security, and privacy).

UNIT 3: Security and Privacy for Internet of Things
Definitions, notions, relations, needs, threats, requirements; Privacy Enhancing Technologies (PET), etc. discussion on security threats on specific IoT applications (unauthorized access, side-channel attacks, safety ricks); cyber security overview in IoT, data privacy in IoT: introduction to privacy enhancing techniques including keyword search and differential privacy, device/user authentication in IoT: introduction to authentication techniques including password, biometric, proximity-based, and behaviour-based techniques, data trustworthiness problem in IoT and some mechanisms to enhance data trustworthiness.
UNIT 4: Literature Review


Text Books and References:


