GURU KASHI UNIVERSITY

M.Tech Computer Science & Engineering

Session: 2023-24

Department of Computer Science & Engineering

GRADUATE OUTCOME OF THE PROGRAMME

The programme focuses on higher education and research activities, with the aim of emerging as leaders in engineering, management, applied research.

PROGRAMME LEARNING OUTCOMES

After completing the programme, the Learner will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, review research literature, and analysis complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
7. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
8. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
9. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Programme Structure

Semester: I						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MCS101	Advanced Computer Architecture	Compulsory Foundation	4	0	0	4
MCS102	Advanced Database Management Systems	Core Course	4	0	0	4
MCS111	Machine Learning	Core Course	4	0	0	4
MCS112	Advanced Database Management System Lab	Skill Based	0	0	4	2
Discipline Elective-I (Any one of the following)						
MCS113	Soft Computing	Discipline Elective	3	0	0	3
MCS110	Distributed System					
MCS114	Cyber Security					
Discipline Elective-II (Any one of the following)						
MCS115	Recommender System	Discipline Elective	3	0	0	3
MCS116	Digital forensics					
MCS117	Digital Image Processing					
Total			**18**	**0**	**4**	**20**

Semester: II						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MCS216	Advanced Data Structures	Core Course	4	0	0	4
MCS217	Advanced Software Engineering & Testing	Core Course	4	0	0	4
MCS218	Cloud Computing	Core Course	3	0	0	3
MCS203	Mini Project	Skill Based	0	0	2	1
Discipline Elective-III (Any one of the following)						
MCS209	Compiler Design	Discipline Elective	3	0	0	3
MCS210	Design and Analysis of Advanced Algorithms					
MCS208	Advanced Computer Graphics					
Discipline Elective-IV (Any one of the following)						
MCS212	Wireless and Mobile Networks	Discipline Elective	3	0	0	3
MCS219	Security Engineering					
MCS214	Data Warehousing & Data Mining					
Value Added Course (Any one of the following)						
MCS220	English for Research Paper Writing	VAC	2	0	0	2
MCS221	Value Education					
MCS204	Constitution of India					
Total			**19**	**0**	**2**	**20**

Semester: III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MCS309	Research Methodology	Research Based	4	1	0	5
MCS301	Dissertation Phase-I	Research Based	0	0	0	6
MCS399	xxx	MOOC	-	-	-	4
Discipline Elective-V (Any one of the following)						
MCS310	Big Data Analytics	Discipline Elective	3	0	0	3
MCS311	Data Visualization					
MCS312	Data Science					
Open Elective Course						
xxx	xxx	OEC	2	0	0	2
Total			**9**	**1**	**0**	**20**
Open Elective Course(For other Department)						
OEC011	Cyber Law & Ethics		2	0	0	2

Semester: 4th						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MCS401	Dissertation Phase-II	Research Based	-	-	-	20
Total			46	1	06	80

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]
   CA1-Surprise Test (Two best out of Three) - (10 Marks)
   CA2-Assignment(s) (10 Marks)
   CA3-Term Paper/Quiz/Presentations (05 Marks)
B. Attendance: [05 marks]
C. Mid Semester Test: [30 Marks]
D. End-Term Exam: [40 Marks]

Evaluation Criteria for Practical Courses

Performance of each practical-(10 Marks)
Report- (5 Marks)
Practical Viva – (5 Marks)
Total - (20 Marks) (Each Practical)

SEMESTER-I

Course Title: Advanced Computer Architecture

Course Code: MCS101

L	T	P	Credits
4	0	0	4

Total hour: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Discuss memory organization and mapping techniques.
2. Demonstrate concepts of parallelism in hardware/software.
3. Define architectural features of advanced processors.
4. Examine the Interpretation performance of different pipelined processors.

Course Content

UNIT-I **15 Hours**

Parallel Computer Models: Multiprocessors and multicomputer, Multifactor and SIMD computers, Architectural development tracks Program and network properties, Conditions of parallelism, Data and resource dependencies, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Program flow mechanisms, Control flow versus data flow, Data flow architecture, Demand driven mechanisms, Comparisons of flow mechanisms

UNIT-II **15 Hours**

Processors and Memory Hierarchy: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures. Hierarchical memory technology, Memory capacity planning, Virtual Memory Technology, Cache addressing models, direct mapping and associative caches.

UNIT-III **15 Hours**

Vector and Symbolic Processors: Inclusion, Coherence and Locality, Backplane Bus System Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt,

Pipelining: Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, dynamic instruction scheduling, Branch handling techniques.

UNIT-IV **15 Hours**

Vector Processing Principles: Vector instruction types, Vector-access memory schemes.
Synchronous Parallel Processing. SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, SIMD Computers and Performance Enhancement. Arithmetic Pipeline Design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipelines

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Mano M.M. (1990). Computer System Architecture, PHI.*
- *Hayes J.P. (1998). Computer Organization and Architecture, TMH.*
- *William Stallings. (1990). Computer System Architecture, PHI.*
- *Hwang and Briggs. (1986). Computer Architecture and Parallel Processing, MGH.*

Course Title: Advanced Database Management System

Course Code:MCS102

L	T	P	Credits
4	0	0	4

Total hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquire the knowledge of Query optimization, Parallel and distributed database systems, new database architectures and query operators.
2. Develop new methods in databases based on knowledge of existing techniques.
3. Apply acquired knowledge for developing holistic solutions based on database systems/database techniques.
4. Explain the principles of concurrency control.

Course Content

UNIT-1 **15 Hours**

Distributed DBMS: Transaction Processing, Concurrency & Recovery Management in Centralized DBMS. Concept of Transaction and its properties, scheduling of transactions, Conflict operations, Two Phase Locking protocol, Recovery management in Centralized DBMS.

Concepts and Design: Introduction, functions and architecture of a DDBMS, distributed relational database design, Transparencies in DDBMS, Date's twelve rules for a DDBMS. Advanced Concepts. Distributed transaction management, distributed concurrency control, distributed deadlock management, distributed database recovery, Replication servers, and Distributed query optimization, Mobile databases.

UNIT-II **15 Hours**

Object-Oriented DBMS: Introduction, advanced database applications, weakness of RDBMS, storing objects in a relational database, next-generation database systems. Concepts and Design. OODBMS perspectives, persistence, issues in OODBMS, advantages and disadvantages of OODBMS, Object-oriented database design. Object Relational DBMS Introduction, third generation database manifestos, SQL8, Object oriented extensions in Oracle, Comparison of ORDBMS and OODBMS.

UNIT-III **15 Hours**

Web Technology and DBMS: Web as a database Application Platform, Requirements for web-DBMS integration, web-DBMS architecture, advantages and disadvantages of web-DBMS approach, approaches to integrating the web and DBMS, Oracle Internet Application Server (IAS).

UNIT-IV **15 Hours**

Data Warehousing Concepts, OLAP and Data mining: Evolution of data warehousing, data warehousing concepts, benefits and problems of data warehousing, comparison of OLTP systems and data warehousing, On-Line Analytical Processing, Introduction to data mining.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Thomas Connolly, Carolyn Begg. (1996). Database Systems, Dorling Kingsley.*
- *H. F. Korth, A. Silverschatz. (1997). Database Concepts, Tat Hill.*
- *Hoofer, Prescott, McFadden. (2007). Modern Database Management, Pearson education.*
- *C.S.R. Prabhu. (2005). Object-oriented Database Systems, Eastern Economy Edition.*

Course Title: Machine Learning

Course Code: MCS111

L	T	P	Credits
4	0	0	4

Total hours: 60

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Develop mathematical thinking and problem-solving skills associated with research and writing proofs.
2. Examine an exposure to a wide variety of mathematical concepts used in computer science discipline like probability.
3. Use Graph Theory for solving problems.
4. Acquire basic knowledge of sampling and estimation.

COURSE CONTENT

UNIT-I **17 Hours**

Introduction: Introduction to machine learning, use of machine learning, type of machine

Learning: supervised, unsupervised and reinforcement learning, Main challenges in machine learning

Preparation of Model: Introduction to Statistical Learning, Significance of Mean, Mode, Median, variance, standard deviation, Basic types of data in machine learning, exploring structure of data, Data quality and remediation, Data pre-processing.

Modeling and evaluation: Model Selection, Training, Model representation and

Interpretability, evaluating performance of a model.

UNIT-II **13 Hours**

Supervised Learning (Regression/Classification):

Basic methods: Distance-based methods, Decision Trees, random forest model, Naive Bayes Linear models: Simple Linear Regression, Multiple linear regression, Polynomial regression, Logistic Regression.

UNIT-III **15Hours**

Unsupervised Learning (Clustering): Different types of clustering techniques, k-medoids clustering, K-means/Kernel K-means, Hierarchical clustering

Dimensionality Reduction: Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Introduction to Matrix Factorization and Matrix Completion

UNIT-IV **15 Hours**

Support Vector Machines (SVM): Linear learning machines and Kernel space, Making Kernels and working in feature space, SVM for classification and regression problems. Recent trends in machine learning.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Saikat Dutt, Subramanian Chandra mouli and Amit Kumar Das, Machine Learning", Pearson, 2019.*
- *Oliver Theobald, Machine Learning for Absolute Beginners: A Plain English Introduction(Second Edition, 2017).*

Course Title: Advanced Database Management System Lab

Course Code:MCS112

L	T	P	Credits
0	0	4	2

Total hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret practical knowledge in designing and creating relational database systems.

2. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

3. Use of various software to design and build ER Diagrams, UML, Flow chart for related database systems.

4. Design and implement database applications using Server-side.

Course Content
List of Programs:

1. Familiarization of the MySQL database – creation and manipulation of tables.
2. Analyze a given situation, develop an ER model and convert the ER model to Relational model.
3. Implement the database using MySQL and manipulate the tables using SQL commands.
4. Course project topic selection, developing an ER model and converting ER model to a Scheme
5. Developing a data flow diagram for the problem specification
6. Implementation of front-end pages
7. Implementation of server-side pages and verifying the normalization Testing the constraints and project Submission and evaluation of project

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Course Title: Soft Computing

Course Code: MCS113

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Classify the basic concepts and the terminology of the soft computing techniques.
2. Understand and appreciate the soft computing techniques and to identify the situations where soft computing techniques are applicable.
3. Apply Soft Computing techniques as computational tools to solve a variety of problems related to optimization and machine learning.
4. Design and experiment with variations of Genetic Algorithms.

Course Content

UNIT-I **10 Hours**

Working of a simple Genetic Algorithm and the related definitions: Representation/Encoding Schemes, initializing a GA population, evaluation function, genetic operators, study of parameters of genetic algorithms and its performance, sampling and selection mechanisms, mathematical foundations of genetic algorithms, schemata theorem and building block hypothesis, optimizing numerical functions using GA. 19

UNIT-II **10 Hours**

Genetic Algorithm variations: Scaling fitness, Niching and speciation, Crowding Technique for Multimodal Problems, Multi-Objective Genetic Algorithms, Master Slave and Distributed Genetic Algorithms, Designing GAs for numerical optimization, knapsack problem, travelling salesperson and other similar problems.

UNIT-III **15 Hours**

Neural networks: Basic terminology and definitions, Model of an artificial neuron, Sigmoid function, Neural Network Architectures, Characteristics of neural

networks, Learning methods, Rosenblatt's Perceptron, Fixed increment perceptron learning algorithm for a classification problem, Examples of learning of AND/OR gate by perceptron, XOR problem. Back Propagation Neural Networks: Architecture of a backpropagation network, Model for multi-layer perceptron, Back propagation learning, Delta or gradient descent learning rule and effect of learning rate, Back propagation learning algorithm.

UNIT-IV **10 Hours**

Fuzzy sets: Basic terminology and definitions, Operations on Fuzzy sets, MF formulations and parameterization, Derivatives of parameterized MFs, Fuzzy numbers, Extension principal and fuzzy relations, Linguistic variables, Fuzzy If-Then Rules, Fuzzy reasoning and compositional rule of inference.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *David.E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning, Addison Wesley, 1999.*
- *ZbigniewMichalewicz, Genetic algorithms +Data Structures = Evolution Programs, Springers-Verlag, 1999.*
- *M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.*
- *S. Rajasekaran& G. A. VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI, 2003.*
- *S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India, 2007.*
- *J-S. R. Jang, C.-T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 1997.*
- *Simon O. Haykin, Neural Networks, A Comprehensive Foundation, PHI, 1994*

Course Title: Distributed System

Course Code: MCS110

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Understand the hardware and software issues in modern distributed systems
2. knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
3. Analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
4. Acquire the knowledge about Shared Memory Techniques.

Course Content

UNIT-I **10 Hours**

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts Distributed Database Management System Architecture Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II **10 Hours**

Distributed Database: Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. Basics of semantic data control, query processing issues Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III **15 Hours**

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of Transaction Models. Concurrency

Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV **10 Hours**

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols. Parallel Database Systems, Parallel architectures; parallel query processing and optimization; load balancing. Advanced Topics, Mobile Databases, Multi-databases.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *George Coulouris, Jean Dollimore, Tim Kindberg(1996).Distributed Systems: Concepts and Design, Addison-Wesley.*
- *Pradeep k. sinha(1998). Distributed Operating Systems: Concepts and Design,PHI Learning Pvt. Ltd.*

Course Title: Cyber Security

Course Code:MCS114

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyse the concept of cybercrimes.
2. Classify about the regulation of cyber space at national and international level.
3. Learn the international legal regime related to cyber-Crime.
4. Discuss the offences and penalties under it act 2000.

Course Content

UNIT – I **15Hours**

General introduction and Cyber space regulations: Cyber Space-Meaning and characteristics Need for regulation of cyber space, Cyber-libertarianism, Cyber-paternalism, Lessing's model of regulation, Regulators in cyberspace, Introduction to Internet, ACLU v Reno, Digitization and Society, Legal Challenges of the Information Society, Information Technology Act, 2000

UNIT – II **10Hours**

Cyber law and IPR issues: Digital Copyrights, Open Source, Linking and caching, Digital Rights Management, DMCA, - Patents, Software Patents Trademarks and domain names, Brand identities, search engines and secondary market, ICANN, Database Right

UNIT- III **10Hours**

Cyber law and privacy and taxations issues: Digitization, personal data and data industry, Data protection principles, Conditions for processing of personal data, CCTV, RFID tracking, Data retention and identity - Taxation issues of e-commerce

UNIT – IV **10Hours**

Cyber Crimes: Computer misuse - identity theft, grooming and harassment, Hacking, Viruses, Criminal damage and mail bombing, Denial of service attack, Obscenity, child abuse, Stalking. Morphing, web jacking, phishing etc., Cyber terrorism, Bandwidth theft, Convention on cyber-Crime

Transactional Modes

Video based Teaching, Collaborative Teaching, Cooperative Teaching, Case based Teaching, Case Analysis, and Group Discussion

Suggested Readings

- *Senthil, Surya and Devi Lakshmi (2010). Manual of Cyber Laws. New Delhi: Aditya Book Company.*
- *Singh, Ranbir and Singh Ghanshyam (2004). Cyber Space and the Law: Issues and Challenges, Hyderabad: Nalsar University.*

Course Title: Recommender System

Course Code:MCS115

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the principles and concepts of recommender systems.
2. Explore different algorithms and techniques used in collaborative filtering and content-based filtering.
3. Understand the evaluation metrics and methods used to assess the performance of recommender systems.
4. Explore advanced topics in recommender systems, such as matrix factorization, deep learning-based approaches, and context-aware recommendations.

Course Content

UNIT-I **10 Hours**

Introduction Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Impact of Bad Ratings, Applications of recommendation systems, Issues with recommender system.

UNIT-II **15 Hours**

Content-based Filtering High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, discovering features of documents, pre-processing and feature extraction, obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Collaborative Filtering User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

UNIT-III **10 Hours**

Hybrid approaches Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies

UNIT-IV **10 Hours**

Evaluating Recommender System Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Trust-Based Recommendation, Recommending for Groups, Context-Aware Recommendation, Cross-domain Recommendations

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *An Introduction, Cambridge University Press 1st ed. Jannach D., Zanker M. and FelFering A. 2011*
- *Recommender Systems: The Textbook, Springer (2016), 1st ed. Charu C. Aggarwal 2016*
- *Recommender Systems Handbook, Springer (2011), 1st ed. Ricci F., Rokach L., Shapira D., Kantor B.P 2015*
- *Recommender Systems for Learning, Springer (2013), 1st ed. Manouselis N., Drachsler H., Verbert K., Duval E.*

Course Title: Digital Forensics

Course Code:MCS116

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Contrast digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.
2. Understand Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy.
3. Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards.
4. Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity.

Course Content

UNIT–I **10 Hours**

Introduction: Understanding the need of Computer Forensics, Definitions

Computer Hardware: Analysis of sources for digital evidence, Digital Media, Hard disk basics, mobile phones

UNIT–II **10 Hours**

Files and File Systems: Windows file systems, Forensic file images, metadata, File signatures

Forensic software: Different software packages, Basic search queries, ASCII, UNICODE, Regular expressions, viewing and managing keywords and cases, Encryption, password protection, Password recovery tools.

UNIT–III **10 Hours**

Physical evidence: fingerprints or other evidence on machines, keyboards

Forensic Reports: Proper report writing, Explaining forensics to the uneducated

Email analysis: IP tracking, Tracking and analysis of emails, Webmail, POP, IMAP

UNIT–IV **15 Hours**

File signature analysis: File signatures, File extensions, Detecting file manipulation

Hash Analysis: Hashing files, Hash libraries

Window Artifacts: My documents, recycle bin, Installed programs, Windows XP vs. Windows 7

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *R. Boddington, Practical Digital Forensics, Packt Publishing, 2016.*
- *N. Jain, D. Kalbande, Digital Forensic: The Fascinating World of Digital Evidences, Wiley, 2016.*
- *M.J. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson, 2008.*
- *J. Marcella, G. Guillossou, Cyber Forensics: from data to digital intelligence, Wiley, 2012*

Course Title: Digital Image Processing

Course Code: MCS117

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Understand Two-dimensional signal acquisition, sampling, and quantization
2. Acquire a good understanding of the mathematical foundations for digital manipulation of images such as image acquisition, preprocessing, segmentation, compression and representation.
3. Learn and understand the image enhancement in the spatial domain and frequency domain.
4. Analyze a wide range of problems and provide solutions related to the design of image processing systems and apply these techniques to real world problems.

Course Content

UNIT-I **15 Hours**

Introduction and fundamental to digital image processing: What is digital image processing, Origin of digital image processing, Examples that use digital image processing, Fundamental steps in digital image processing, Components of digital image processing system, Image sensing and acquisition, Image sampling, Quantization and representation, Basic relationship between pixels. Image enhancement in spatial domain: Background, Basic gray level transformation, Histogram processing, Basics of spatial filtering, Smoothing and sharpening spatial filters

UNIT-II **10 Hours**

Image enhancement in frequency domain: Introduction to Fourier transform, sampling, discrete Fourier transform, extension to functions of two variables, Basics of filtering in frequency domain, Smoothing and sharpening frequency domain filters.

Image Restoration: Image degradation/restoration Process, Noise models, Restoration in presence of noise, Inverse filtering, Minimum mean square filtering, Geometric mean filter, Geometric transformations.

UNIT-III **10 Hours**

Color Image Processing: Color fundamentals, Color models, Basics of full color image processing, Color transformations, Smoothing and sharpening.

Image Compression: Fundamentals, Spatial and temporal redundancy, Measuring image information, Image compression methods, Loss less compression, Lossy compression, Digital image watermarking.

UNIT-IV **10 Hours**

Image Segmentation: Fundamentals, Point, line and edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation.

Representation, Description and Recognition: Representation-chain codes, polygonal approximation and skeletons, Boundary descriptors-simple descriptors, shape numbers, regional descriptors- simple, topological descriptors, Pattern and Pattern Classes-Recognition based on matching techniques and neural networks.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rafael C. Gonzalez and Richard E. Woods, —Digital Image Processing‖, Pearson Education,Ed, 2001.*
- *Anil K. Jain, —Fundamentals of Digital Image Processing‖, Pearson Education, PHI, 2001.*
- *Tinku Acharya and Ajoy K. Ray, —Image Processing-Principles and Applications‖, John Wiley & Sons, Inc., 2005.*
- *Chanda and D. Dutta Majumdar, —Digital Image Processing and Analysis‖, PHI, 2003.*
- *Milan Sonka, Vaclav Hlavac, Roger Boyle, —Image Processing, Analysis, and Machine Vision‖, Brookes/ Cole, PWS Publishing Company, Thomson Learning, 2 nd edition,1999.*

SEMESTER-II

Course Title: Advanced Data Structures

Course Code: MCS216

L	T	P	Credits
3	1	0	4

Total hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design and implement an appropriate hashing function for an application.
2. Demonstrate different methods for traversing trees.
3. Describe common applications for arrays, records, linked structures, Stacks, queues, trees, and graphs
4. Compare and contrast the benefits of dynamic and static data Structures implementations

Course Content

UNIT-I **15 Hours**

Complexity Analysis: Asymptotic notations, Properties of big oh notation, asymptotic notation with several parameters, conditional asymptotic notation, amortized analysis, NP completeness, NP-hard, recurrence equations, solving recurrence equations.

UNIT-II **15 Hours**

Elementary Data Structures& Basics Applications: Arrays, linked lists, trees and sparse matrices. Heap Structures Min-max heaps, Heaps, Leftist heaps, Binomial heaps, Fibonacci heaps, skew heaps, Lazy-binomial heaps.

UNIT-III **15 Hours**

Search Structures: Binary search trees, AVL trees, 2-3 trees, 2-3-4 trees, Red-black trees, B trees. Multimedia Structures Segment trees, k-d trees, Point Quad trees, MX-Quad trees, R-trees, Trees. Graph Algorithms, Topological sort, minimum Spanning tree, single-source shortest paths, all-pairs shortest paths, bi-connected components, strongly connected components, cycles, articulation points, bridges.

UNIT-IV **15 Hours**

Applications: Huffman coding, Garbage collection and compaction, Topological sort, Min cut max flow algorithm, Activity networks, set representation, set union and find operations, counting binary trees.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Horowitz, S.Sahni and Dinesh Mehta. (2008). Fundamentals of Data structures in C++, universities*
- *Adam Drozdex. (1993). Data Structures and algorithms in C++.Thomson learning, Vikas publishing house.*
- *Lipschutz Seymour. (2014). Theory and Problems of Data Structures, Schaum's series.*
- *BalujaG.S. (2016). Data structures through C++, PHI.*

Course Title: Advanced Software Engineering & Testing

Course Code: MCS217

L	T	P	Credits
4	0	0	4

Total hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.
2. Describe software measurement and software risks.
3. Discuss software evolution and related issues such as version management
4. Apply new software models, techniques and technologies to bring innovative and novelistic solutions for the growth of the society in all aspects.

Course Content

UNIT-I **15 Hours**

Principles and Motivations: History, Definitions; Engineering approaches to software development, Software development process models from the points of view of technical development and project management, waterfall, rapid prototyping, in Credential development, spiral models, Agile Software Development, Emphasis on computer-assisted environments. Selection of appropriate development process.

Software Development Methods: Formal, semi-formal and informal methods; Requirement's elicitation, requirements specification; Data, function, and event-based modeling; Some of the popular methodologies such as Yourdons SAD, SSADM etc; CASE tools-classification, features, strengths and weaknesses; ICASE; CASE standard

UNIT-II **15Hours**

Software Project Management: Principles of software projects management; Organizational and team structure; Project planning; Project initiation and Project termination, Technical, quality, and management plans; Project control; Cost estimation methods, Function points and COCOMO

UNIT-III **15 Hours**

Software Quality Management: Quality control, quality assurance and quality standards with emphasis on ISO 9000; Functions of software QA organization in a project; interactions with developers; Quality plans, quality assurance towards quality improvement; Role of independent verification & validation; Total quality management; SEI maturity model; Software metrics.

UNIT-IV **15 Hours**

Configuration Management: Need for configuration management; Configuration management functions and activities; Configuration management techniques; Examples and case studies. Software Testing Fundamentals**,** Basic Terminology, Testing Techniques and strategies. Brief introduction to various standards related to Software Engineering.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Pressman, Roger. (2021) Software Engineering - A Practitioners Approach, McGraw Hill.*
- *Somerville, Ian. (2011). Software Engineering, Addison-Wesley Publishing Company.*
- *Peter, James F. (2005). Software Engineering. An Engineering Approach, John Wiley.*
- *Jalote, Pankaj. (2005). An integrated Approach to Software Engineering, Narosa.*

Course Title: Cloud Computing

Course Code:MCS218

L	T	P	Credits
3	0	0	3

Total hours:45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the Reference Model, Benefits, Limitations, Open Challenges, Grid and Utility Computing.
2. Demonstrate Service Models, Deployment Models, Cloud Entities, Cloud Clients, and Cloud Programming Models.
3. Describe Cloud Security: Infrastructure Security, Data Security, Identity and Access Management, Privacy Management, Security as a Service on Cloud
4. Classify Resource Provisioning, Bill Management, Multitenancy and Isolation, Service Level Agreement (SLA) and Quality of Service (QoS)

Course Content

UNIT-I **15 Hours**

Introduction: Definition, Vision, Reference Model, Benefits, Limitations, Open Challenges, Grid and Utility Computing.

Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance.

UNIT-II **10 Hours**

Cloud Computing Architecture: Service Models, Deployment Models, Cloud Entities, Cloud Clients, Cloud Programming Models.

Cloud Terminology: Resource Provisioning, Bill Management, Multitenancy and Isolation, Service Level Agreement (SLA) and Quality of Service (QoS), Mobile Cloud Computing.

UNIT-III **10 Hours**

Cloud Security: Infrastructure Security, Data Security, Identity and Access Management, Privacy Management, Security as a Service on Cloud.

UNIT-IV **10 Hours**

Big-Data and Internet of Things (IoT): Definition of Big-Data, Structured and Unstructured Data, Vs of Big-Data, Hadoop, Definition of IoT, Characteristics of IoT, Combining Big-Data, IoT and Cloud Computing.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Sunil KumarManvi .(2018). Cloud Computing: Concepts and Technologies, CREDITSC Press*
- *Judith Hurwitz.(2020). Cloudcomputing for Dummies, Wiley*
- *Miller .(2008). Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson*

Course Title: Mini Project

Course Code:MCS203

L	T	P	Credits
0	0	2	1

Total hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Engage in independent study to research literature in the identified domain
2. Consolidate the literature search to identify and formulate the engineering problem
3. Identify the community that shall benefit through the solution to the identified engineering problem and also demonstrate concern for environment
4. Demonstrate compliance to the press Cribbed standards/ safety norms through implementation of the identified engineering problem

Course Content

To achieve a desired outcome at a specific end date employing a specific number of resources.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Course Title: Compiler Design

Course Code: MCS209

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze the lexical, syntactic and semantic structures of advanced language features
2. Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. Explain the concepts and different phases of compilation with compile time error handling
4. Design a compiler for a simple programming language

Course Content

UNIT-I **15 Hours**

Compiler Structure: Analysis-synthesis model of compilation, various phases of a compiler, tool-based approach to compiler construction. Lexical analysis, interface with input, parser and symbol table, token, lexeme and patterns. Difficulties in lexical analysis. Error reporting, Implementation, Regular definition, Transition diagrams, LEX.

UNIT-II **10 Hours**

Syntax Analysis: CFG, ambiguity, associatively, precedence, top-down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC. Syntax directed definitions, inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top-down evaluation of attributes, L- and S-attributed definitions.

UNIT-III **10 Hours**

Type Checking: Type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions. Run time system, storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

UNIT-IV **10 Hours**

Intermediate Code Generation: Intermediate representations, translation of declarations, assignments, control flow, Boolean expressions and procedure calls. Implementation issues. code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *V. Aho, R. Sethi, and J. D. Ullman. (2003). Compilers: Principles, Techniques and Tools,Addison-Wesley.*
- *C. Fischer and R. LeBlanc. (1993). a Compiler, Benjamin Cummings.*
- *C. Fischer and R. LeBlanc. (2001).a Compiler in C, BenjaminCummings.*
- *A. C. Holub. (1997). Compiler Design in C, Prentice-HallInc.*

Course Title: Design and analysis of advanced algorithms

Course Code: MCS210

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Define the basic concepts of algorithms and analyze the performance of algorithms.
2. Discuss various algorithm design techniques for developing algorithms.
3. Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions, typically using the following algorithms.
4. Use of various searching, sorting and graph traversal algorithms.

Course Content

UNIT-I **10 Hours**

Analysis of algorithms: Notation for Algorithms, Complexity of Algorithm, Growth of functions, Models of computation, Algorithm control structures, Performance analysis

UNIT-II **15 Hours**

Elementary Data Structures: Stacks and Queues, Lists, Trees, Dictionaries, Set and graphs. Basic design methodologies, In Credential& Divide and conquer Approach, Dynamic Programming, Backtracking, Greedy algorithms, Branch and Bound.

UNIT-III **10 Hours**

Particular Algorithms: Disjoint set manipulation, Matrix multiplication, Pattern matching, Sorting and Searching algorithms, combinatorial algorithms, String processing algorithms, Algebraic algorithms.

UNIT-IV **10 Hours**

Graph Algorithms: Problem classes, NP-completeness, Deterministic and Nondeterministic, polynomial time algorithms, theory of lower bounds, Approximation algorithms.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Aho. (2002). Design & Analysis of Computer Algorithms, Pearson Education.*
- *Horowitz, S. Sahni. (1984). Fundamentals of Computer Algorithms, Galgotia Publishers.*
- *Knuth. (1968). The Art of Programming, Pearson Education.*
- *Nitin Upadhyay. (2004). The Design & Analysis of Algorithms. K. Kataria publication.*

Course Title: Advanced Computer Graphics

Course Code: MCS208

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Learn mathematical operations to develop Computer programs.
2. Understand scientific and strategic approach to solve complex problems in the domain of Computer Graphics.
3. Define the concepts related to Computer Vision and Virtual reality.
4. Apply the logic to develop animation and gaming programs.

Course Content

UNIT-I **15 Hours**

Introduction: Fundamentals of Computer Graphics, Applications of computer graphics. Programming in the Simple raster Graphics Package, Drawing with SRGP, Basic Interaction Handling, Raster Graphics Features, Limitation of SRGP Basic Raster Graphics, Algorithms for Drawing 2D Primitives, Overview, Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses, Filling Rectangles, Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primitives, Line Style and Pen Style, Clipping in a Raster World, Clipping lines, Clipping Circles and Ellipses, Clipping Polygenes, Generating Characters, SRGP- copy pixel, Antialiasing

UNIT-II **10 Hours**

Graphics Hardware: Hard copy Technologies, Display Technologies, Raster Scan Display Systems, Video Controller, Random Scan Display Processor, Input Devices for Operator Interaction, Image Scanner Geometrical transformations, 2-D transformations, homogenous co-ordinates & Matrix Representation of 2-D transformations, Window-to-view port transformation, Efficiency, matrix representation of 3-D transformations, composition of 3-D transformations, Transformations as a change in co-ordinate system.

UNIT-III **10 Hours**

Viewing in 3-D: Projections, specifying an arbitrary 3-D view, Examples of 3-D viewing, Mathematics planar geometric projections, implementing planar geometric projections, co-ordinate systems Visible surface determination, Visible Surface Detection Back-Face detection, Depth-Buffer method, The Z-Buffer algorithm, The Painter's Algorithm, Scan line algorithms, Area-subdivision algorithms. Illumination and Surface-Rendering Methods Basic Illumination models, Halftone patterns and Dithering Techniques, Polygon-Rendering methods, adding surface details.

UNIT-IV **10 Hours**

Advance Raster Display System: Simple Raster Display System, Display Processor System, Standard Graphics Pipeline, Introduction to Multiprocessing, Pipeline Front End Architectures, Parallel Front End Architecture, Multiprocessor Rasterization Architecture, Image Parallel Rasterization, Object Parallel Rasterization, Hybrid Parallel Rasterization, Enhanced Display Capabilities.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Hern and Baker. (2000). Computer Graphics, PHI, New Delhi.*
- *William Newman.(2001). Principles of Computer Graphics, McGraw Hill Education.*
- *Schaum's.(2000). Outline Series Computer Graphics, MGH Publications.*

Course Title: Wireless and Mobile Networks

Course Code: MCS212

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Conversant with the latest 3G/4G and Wi-MAX networks and its architecture.
2. Design and implement wireless network environment for any application using latest wireless protocols and standards.
3. Implement different type of applications for smart phones and mobile devices with latest network strategies
4. Compare and contrast multiple division techniques, mobile communication systems, and existing wireless networks.

Course Content

UNIT-I **10 Hours**

Overview of wireless sensor networks: Challenges for Wireless Sensor Networks, Single Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes- Radio Energy Consumption Model, Operating Systems and Execution Environments, Applications of WSN, Computational models, Performance metrics

UNIT II **15 Hours**

Networking sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC,The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-III **10 Hours**

Infrastructure establishment: Sensor deployment mechanisms- uniform random deployment, grid deployment, Time Synchronization- Introduction, Protocol based on sender- receiver synchronization, Issues of coverage, Node discovery protocols, Localization Schemes, Network clustering, Topology Control.

UNIT IV **10 Hours**

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Holger Karl & Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley, 2005.*
- *Feng Zhao & Leonidas J. Guibas, 'Wireless Sensor Networks- An Information ProcessingApproach', Elsevier, 2007.*
- *KazemSohraby, Daniel Minoli, &TaiebZnati, 'Wireless Sensor NetworksTechnology, Protocols, And Applications', John Wiley, 2007.*
- *Anna Hac, 'Wireless Sensor Network Designs', John Wiley, 2003*

Course Title: Security Engineering

Course Code:MCS219

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use of various concepts related to engineering secure systems by keeping various threats in mind.
2. Understand the principles related to use of authentication mechanism, their form, security analysis, overhead, use of security standards related to cryptography and physical security.
3. Examine the building systems using passwords, biometrics, CAPTCHA's, secure programming techniques, trusted computing, Crypto APIs and physical security.
4. Understand a variety of security attacks, their sophistication, and defense mechanisms.

Course Content

UNIT-I **10 Hours**

Introduction to Security Engineering: Passwords and their limitations, attacks on passwords, CAPTCHA, Biometrics. Access Control, ACL, sandboxing, virtualization, trusted computing. Multi-level and multi-lateral security.

UNIT-II **10 Hours**

Securing services: Security in Metered Services, pre-payment meters, secure printing and seals. Tamper resistance mechanisms. Secure systems: hardware, software and communication systems – design issues and analysis.

UNIT-III **15 Hours**

Secure software architecture: Models and principles, hardware design related security – smart cards and other security solutions, communication protocols and application systems associated with security.

UNIT-IV **10 Hours**

Attacks and defenses: Phishing, social networking attacks, Denial of service, API attacks, network attacks and countermeasures, side-channel attack, advanced persistent Threats (APTs), copyright and DRM.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Ramesh s. Gaonkar. (2013) Microprocessor Architecture, Programming and Application with 8085, Penram International publishing India Pvt. Ltd.*
- *Douglas. V Hall. (2006). Microprocessor andinterfacing, Tata Mc-GrawHill Publication.*

Course Title: Data Warehousing & Data mining

Course Code:MCS214

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design and deploy appropriate classification techniques
2. Cluster the high dimensional data for better organization of the data
3. Discover the knowledge imbibed in the high dimensional system
4. Evolve Multidimensional Intelligent model from typical system

Course Content

UNIT-I **10 Hours**

The Compelling Need for data warehousing: Escalating Need for strategic information, Failures of past decision-support systems, operational versus decision-support systems, data warehousing – the only viable solution, data warehouse defined. Data warehouse – the building blocks. defining Features, data warehouses and data marts, overview of the components, and metadata in the data Warehouse. Defining the business requirements. Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition, scope and content.

UNIT-II **10 Hours**

Principles of dimensional modeling: Objectives, From Requirements to data design, the STAR schema, STAR Schema Keys, Advantages of the STAR Schema, Dimensional Modeling, Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, aggregate fact tables, families of STARS.

UNIT-III **15 Hours**

OLAP in the Data Warehouse: Demand for Online analytical processing, need for multidimensional analysis, fast access and powerful calculations, limitations of other analysis methods, OLAP is the answer, OLAP, definitions and rules, OLAP characteristics, major features and functions, general features, dimensional analysis, what are hyper cubes?, Drill-down and roll-up, slice-and-dice or rotation,

OLAP models, overview of variations, the MOLAP model, the ROLAP model, ROLAP versus MOLAP, OLAP implementation considerations

UNIT-IV **10 Hours**

Data Mining Basics: What is Data Mining, Data Mining Defined, the knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining, applications in retail industry, applications in telecommunications industry, applications in banking and finance.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Kamber, Han. (2000). Data Mining Concepts and Techniques, Hardcourt India P.Ltd.*
- *Laura L. Reeves. (2001). A Manager's Guide to Data Warehousing, Kindle Edition*
- *Pieter Adiaans,Dolfzantinge. (2008). Data Mining, Pearson Education.*

Course Title: English for Research Paper Writing

Course Code: MCS220

L	T	P	Credits
2	0	0	2

Total Hours: 30

Learning Outcomes: After comletion of this course, the learner will be able to:

1. Define the planning and preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.
2. Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.
3. Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
4. Understand the key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Course Content

UNIT-I **10 Hours**

Planning and Preparation: Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Plagiarism: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-II **5 Hours**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT-III **5 Hours**

Key skills: key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-IV **10 Hours**

Writing the Methods: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions

Implementation Process: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Goldbort R. (2006). Writing for Science, Yale University Press. (Available on Google Books)*
- *Day R. (2006). How to Write and Publish a Scientific Paper, Cambridge University Press.*
- *HighmanN. (1998). Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.*

Course Title: Value Education

Course Code: MCS221

L	T	P	Credits
2	0	0	2

Total hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand value of education and self- development
2. Predict the good values in students
3. Examine about the importance of character
4. Comprehend the essential steps to become good leaders

Course Content

UNIT-I **5 Hours**

Values and Self-Development: Social Values and Individual Attitudes. Work Ethics, Indian Vision of Humanism. Moral and Non- Moral Valuation. Standards and Principles. Value Judgements

UNIT-II **5 Hours**

Importance of Cultivation of Values: Sense of Duty. Devotion, Self-Reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of Faith, National Unity. Patriotism, Love for Nature, Discipline

UNIT-III **10 Hours**

Personality and Behavior Development: Soul and Scientific Attitude. Doing Best for Saving Nature Association and Cooperation. Aware of Self-Destructive Habits. Happiness Vs Suffering, Love for Truth. True Friendship. Universal Brotherhood and Religious Tolerance. Free from Anger, Dignity of Labor. Avoid Fault Thinking. Punctuality, Love and Kindness. Positive Thinking. Integrity and Discipline.

UNIT-IV **10 Hours**

Character and Competence: Holy Books vs. Blind Faith. Honesty, Studying Effectively. Mind Your Mind, Self-Control. All Religions and Same Message. Equality, Nonviolence, Humility, Role of Women. Science of Reincarnation. Self-Management and Good Health.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Chakraborty, S.K. (2000). Values and Ethics for organizations Theory and practice, Oxford University Press, New Delhi*
- *Chatterjee, S. R. (1997). Values and Ethics for Organizations: Theory and Practice. The Asia Pacific*

Course Title: Constitution of India

Course Code:MCS204

L	T	P	Credits
2	0	0	2

Total hours: 30

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Understand the meaning and importance of Constitution
2. Examine about making of Indian Constitution-contribution of Constituent assembly on it.
3. Comprehend the salient features of Indian Constitution
4. Predict the importance of Preamble of the Indian Constitution and its significance.

Course Content

UNIT-I **4Hours**

History of Making of the Indian Constitution: History Drafting Committee,

(Composition & working)

Philosophy of the Indian Constitution: Preamble Salient Features.

UNIT-II **6 Hours**

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties

Panchayat raj. Introduction, PRI.Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat, Position and role. Block level. Organizational Hierarchy (Different departments), Village level, Role of Elected and Appointed officials.

UNIT-III **10 Hours**

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Local Administration: District's Administration head: Role and Importance, Municipalities, Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

UNIT-IV **10 Hours**

Election Commission: Election Commission, Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission, Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *M P Jain Indian Constitutional Law: by M.P. Jain (Author), Justice JastiChelameswar (Editor)*
- *Constitution of India for Children: Written by Subhadra Sen Gupta*
- *Introduction to the Constitution of India by DD Basu*

SEMESTR-III

Course Title: Research Methodology

Course Code: MCS309

L	T	P	Credits
4	1	0	5

Total hours: 75

Learning Outcomes: After completion of this course, the learner will be able to: to:

1. Identify and discuss the role and importance of research in the social sciences.
2. Discuss the issues and concepts salient to the research process.
3. Choose the appropriate research design and develop appropriate research hypothesis for a research project
4. Discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.

Course Content

Unit-I **20 Hours**

Research: its concept, nature, scope, need and Objectives of Research, Research types, Research methodology, Research process – Flow chart, description of various steps, Selection of research problem.

Unit-II **20 Hours**

Research Design: Meaning, Objectives and Strategies of research, different research designs, important experimental designs

Methods of Data Collection and Presentation: Types of data collection and classification, Observation method, Interview Method, Collection of data through

Questionnaires, Schedules, data analysis and interpretation, editing, coding, content analysis and tabulation.

Unit-III **20 Hours**

Sampling Methods:

Different methods of Sampling: Probability Sampling methods, Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Non probability Sampling methods, Sample size.

Unit-IV **15Hours**

Report writing and Presentation: Types of reports, Report Format – Cover page, Introductory page, Text, Bibliography, Appendices, Typing instructions, Oral Presentation.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Panneerselvam, R, 'Research Methodology', PHI, New Delhi.
- Cooper, D.R Schindler,P.S., 'Business Research Methods,' Tata McGraw Hill
- Gupta S P,' Statistical Methods', Sultan Chand & Sons, Delhi
- Ronald E Walpole, 'Probability and Statistics for Engineers and Scientists' (International Edition), Pearson Education.
- Geode, Millian J. & Paul K. Hatl, "Methods in Research", McGraw Hills, NewDelhi

Reference Books

- *Kothari C.R., "Research Methodology", New AgePublisher*
- *Nargundkar R, Marketing Research, Tata McGraw Hill, New Delhi,2002.*
- *Sekran, Uma, "Business Research Method", Miley Education,Singapore*

Website/Links/Online Portal/ICT

- https://www.academia.edu/
- https://www.studeersnel.nl
- https://www.scribd.com

Course Title: Dissertation Phase-I

Course Code:MCS301

L	T	P	Credits
0	0	0	10

Total hours: 150

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply knowledge of recent computing technologies, skills and current tools of computer science and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Understand the contemporary research issues in the different areas of computer science & engineering.
4. Explore research gaps, analyze and carry out research in the specialized/ emerging areas.

Course Content

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations with implementation tools with suitable platform.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Course Title: Big Data Analytics

Course Code:MCS310

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe big data and use cases from selected business domains
2. Explain NoSQL big data management
3. Understand the concept of Installing, configuring, and run Hadoop and HDFS
4. Perform map-reduce analytics using Hadoop

Course Content

UNIT-I **15 Hours**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT-II **10 Hours**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT-III **10 Hours**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java

interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

UNIT-IV **10 Hours**

Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging, 2013.*
- *Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.*
- *P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.*
- *Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.*
- *Eric Sammer, "Hadoop Operations", O'Reilley, 2012.*
- *Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.*
- *Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.*
- *Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.*
- *Alan Gates, "Programming Pig", O'Reilley, 2011*

Course Title: Data Visualization

Course Code: MCS311

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Examine the Mathematical Foundations for Data Science
2. Classify Data collections and APIs
3. Analysis the data using data tools
4. Understand the concept of Data visualization

Course Content

UNIT-I **15 Hours**

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications, Mathematical Foundations for Data Science: linear algebra; Analytical and numerical solutions of linear equations; Mathematical structures, concepts and notations used in discrete mathematics. Introduction to Statistical Methods: basic and some advanced concepts of probability and statistics; Concepts of statistics in solving problems arising in data science.

UNIT-II **15 Hours**

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

UNIT-III **15 Hours**

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-IV **15 Hours**

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016*
- *Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.*
- *Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.*
- *Eric Siegel, Thomas H. Davenport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", Wiley, 2013.*
- *James R Evans, "Business Analytics – Methods, Models and Decisions", Pearson 2013.*
- *R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2015.*

Course Title: Data Science

Course Code: MCS312

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use of Mathematical concept in Data Science
2. Describe Data collection and management
3. Understand the Basic machine learning algorithms
4. Define Data visualization: Introduction, Types of data visualization

Course Content

UNIT-I **15 Hours**

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications, Mathematical Foundations for Data Science: linear algebra; Analytical and numerical solutions of linear equations; Mathematical structures, concepts and notations used in discrete mathematics. Introduction to Statistical Methods: basic and some advanced concepts of probability and statistics; Concepts of statistics in solving problems arising in data science.

UNIT-II **15 Hours**

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

UNIT-III **15 Hours**

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-IV **15 Hours**

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013.*
- *Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016*
- *An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013*
- *Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014.*
- *Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015.*
- *Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.*
- *Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.*

Course Title: Cyber Law & Ethics
Course Code: OEC011

L	T	P	Credits
3	0	0	3

Total hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyses the concept of cybercrimes.
2. Learn about the regulation of cyber space at national and international level.
3. Understand the international legal regime related to cybercrimes.
4. Discuss the offences and penalties under it act 2000.

Course Content

UNIT – I **15 Hours**

General introduction and Cyber space regulations: Cyber Space-Meaning and characteristics Need for regulation of cyber space, Cyber-libertarianism, Cyber-paternalism, Lessing's model of regulation, Regulators in cyberspace, Introduction to Internet, ACLU v Reno, Digitization and Society, Legal Challenges of the Information Society, Information Technology Act, 2000

UNIT – II **10 Hours**

Cyber law and IPR issues: Digital Copyrights, Open Source, Linking and caching, Digital Rights Management, DMCA, - Patents, Software Patents Trademarks and domain names, Brand identities, search engines and secondary market, ICANN, Database Right

UNIT III **10 Hours**

Cyber law and privacy and taxations issues: Digitization, personal data and data industry, Data protection principles, Conditions for processing of personal data, CCTV, RFID tracking, Data retention and identity - Taxation issues of e-commerce

UNIT – IV **10 Hours**

Cyber Crimes: Computer misuse - identity theft, grooming and harassment, Hacking, Viruses, criminal damage and mail bombing, Denial of service attack, Obscenity, child abuse, Stalking. Morphing, web jacking, phishing etc., Cyber terrorism, Bandwidth theft, Convention on cybercrime.

Transactional Modes

Video based Teaching, Collaborative Teaching, Cooperative Teaching; Case based Teaching, Case Analysis, and Group Discussion.

Suggested Readings

- *Senthil, Surya and Devi Lakshmi (2010). Manual of Cyber Laws. New Delhi: Aditya Book Company.*
- *Singh, Ranbir and Singh Ghanshyam (2004). Cyber Space and the Law: Issues and Challenges, Hyderabad: Nalsar University.*

SEMESTER-IV

Course Title: Dissertation Phase-II

Course Code:MCS401

L	T	P	Credits
0	0	0	20

Total hours: 300

Learning Outcomes: After completion of this course, the learner will be able to:

1. Create, analyze and critically evaluate different technical/architectural solutions.
2. Analyze the consciousness critically of the ethical aspects of research and development work.
3. Analyze and evaluate different technical/architectural solutions.
4. Explain the capability of critically and systematically integrate knowledge.

Course Content
The dissertation will normally contain:

1. A clear indication, at appropriate stages, of original and critically elements. The level of originality expected is likely to include the application of existing techniques to new environments, the use of original materials, the re-working of existing materials, and the Use of comparative approaches to the provision of information technology;

2. A discussion of its scope and aims, and its theoretical and professional significance, including discussion of the context in which the problem is seen as important;

3. An analysis of the topic within a critically review of the relevant literature;

4. An evaluation of methods used in the dissertation, their reliability, validity, and a comparison with alternative methods;

5. An account of the process of obtaining the data required for the dissertation and the results obtained;

6. An analysis of the results of the dissertation to include a discussion of their significance, their relationship to other research, and any methodological or theoretical implications;

7. The relationship of the findings to existing professional understanding and, where Appropriate, potential implementation difficulties. It is not intended to restrict students to a precisely defined format for the dissertation but it should follow the standard practices of dissertation writing. Although a written report will normally be expected, it should be accompanied by soft copy on CD.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning