GURU KASHI UNIVERSITY

M.Tech Computer Science & Engineering(MCS)

(Single Major)

Session: 2025-26

Faculty of Engineering & Technology

Graduate Attributes of the Programme: -

Type of Course Learning Outcomes	**The Course Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Course Learning Outcomes that are specific to disciplinary/interdisciplinary areas of learning	The programme focuses on higher education and research activities, with the aim of emerging as leaders in engineering, management, applied research. The programme focuses to understand, analyze, develop and efficiently solve problems related to computer-based systems.
Generic Course Learning Outcomes	The generic Course Learning Outcomes for graduates typically include: Problem Analysis, Design and Development, Modern Tool Usage, Lifelong Learning
	1.Apply the knowledge of Computer Science engineering tools and an engineering specialization to the solution of complex engineering problems 2.Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 3.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. 4.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. 5.Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. 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.Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. 9.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 10.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. 11.Life-long learning**:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Course Learning Outcomes: (M. Tech CSE Programme) is awarded to students who have demonstrated the achievement of the outcomes located at level 7:

Element of the Descriptor	**Programme Course Learning Outcomes relating to Master Degree Programme(M.Tech CSE)**
The Post graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	An M.Tech in CSE provides an in-depth understanding of advanced computer science concepts, preparing students for research, industry, and innovation.
	To Understand Entrepreneurial & Industry Readiness
General, technical and professional skills required to perform and accomplish tasks	Ability to analyze complex problems and devise effective solutions. Staying updated with emerging technologies and industry trends.
Application of knowledge and skills	. Graduates Equip with advanced knowledge and skills, enabling them to excel in various professional and research-oriented role.
Generic learning outcomes	Expertise in AI/ML, Data Science, Cybersecurity, Block chain, Cloud Computing, and IoT. Database management (SQL, NoSQL, Big Data technologies like Hadoop, Spark). Software development lifecycle (SDLC) and DevOps practices. Embedded systems and high-performance computing (for specialized domains).
Constitutional, humanistic, ethical, and moral values	88
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Proficiency in cloud platforms
Credit requirements	88
Entry requirements	A student with a Bachelor of Technology subject to fulfillment of the eligibility conditions of a programme as specified by the University, shall be eligible for admission to a 2-year PG Programme.

Programme Structure

Semester: 1st									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int**	**Ext**	**Total Marks**
MCS1450	Advanced Computer Vision	Core course	4	0	0	4	30	70	100
MCS1451	Advanced Database Management Systems	Core course	4	0	0	4	30	70	100
MCS1500	Machine Learning	Core course	4	0	0	4	30	70	100
MCS1501	Advanced Database Management System Lab	Practicum Course (PC)	0	0	8	4	30	70	100
MCS1502	Entrepreneurship Development	Skill Course	2	0	0	2	30	70	100
Discipline-Specific Elective (DSE) -I(Any one of the following)									
MCS1503	Soft Computing	Discipline-Specific Elective (DSE)	4	0	0	4	30	70	100
MCS1504	Cyber Security								
Total			**18**	**0**	**8**	**22**	**180**	**420**	**600**

Semester: 2nd									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int**	**Ext**	**Total Marks**
MCS2550	Big Data Analytics	Core Course	4	0	0	4	30	70	100
MCS2551	Security Engineering	Core Course	4	0	0	4	30	70	100
MCS2552	Internet of Things	Core Course	4	0	0	4	30	70	100
MCS2553	Mini Project	Practical Course	0	0	8	4	30	70	100
MCS2554	English for Research Paper Writing	Skill Course	2	0	0	2	30	70	100
Discipline-Specific Elective (DSE) -II(Any one of the following)									
MCS2555	Distributed System.	Discipline -Specific Elective (DSE)	4	0	0	4	30	70	100
MCS2556	Cognitive Robotics								
Total			**18**	**0**	**8**	**22**	**180**	**420**	**600**

Semester:3rd									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int**	**Ext**	**Total Marks**
MCS3600	Research Methodology	Core Course	4	0	0	4	30	70	100
MCS3601	Biometric Security	Core Course	4	0	0	4	30	70	100
MCS3602	Dissertation-1	Research Based	0	0	0	12	30	70	100
MCS3603	Organizational Behavior	Skill Course	2	0	0	2	30	70	100
Total			**10**	**0**	**0**	**22**	**120**	**280**	**400**

Semester: 4th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int**	**Ext**	**Total Marks**
MCS4650	Dissertation-II	Research Based	-	-		12	30	70	100
MCS4651	Value Education	Skill Course	2	0	0	2	30	70	100
MCS4652	Digital forensics	Core Course	4	0	0	4	30	70	100
Discipline-Specific Elective (DSE) -VI(Any one of the following)									
MCS4653	Data Science	Discipline-Specific Elective (DSE)	4	0	0	4	30	70	100
MCS4654	Cloud Computing								
Total			10	0	0	22	120	280	400
Grand Total			**56**	**0**	**16**	**88**			

Semester – I

Course Title: Advance Computer Vision	L	T	P	Cr.
Course Code: MCS1450	4	0	0	4

Total Hours: 60

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

1. Understand computer vision algorithms for classification, recognition, and detection, and their implementation in deep learning libraries.
2. Know the different types of generative adversarial network and their distinct contributions to controlled data synthesis and image generation.
3. Be able to identify different diffusion models and assess their advantages in generative modeling.
4. Be able to demonstrate awareness and understanding of the latest key research areas in computer vision.

COURSE CONTENT

Unit-I **15 Hours**

Implementation Image Classification using Computer vision and Deep learning techniques like Convolutional Neural Networks and segmentation. Object Segmentation and Detection: Object Segmentation and detection using Python deep learning libraries like PyTorch.

Unit: II **15 Hours**

Introduction to Transfer Learning: What is Transfer Learning, How Transfer Works, and Why Should You Use Transfer Learning? Steps to Use Transfer Learning, Model Building in Transfer Learning, Code Implementation of Transfer Learning.

Unit-III **15 Hours**

Introduction to AI Backend Frameworks: What is AI Backend Framework, Model building with Tensor flow & Pytorch, Other Framework comparison & Use cases. Fine-tuning pre-trained models: Implement the advanced Deep learning concept of Fine-tuning on pre-trained models such as YOLO.

Unit-IV **15 Hours**

Domain adaptation & anomaly detection: Perform the anomaly detection using Transfer Learning 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

- Szeliski, R. (2022). *Computer vision: algorithms and applications*. Springer Nature.
- Forsyth, D. A., & Ponce, J. (2002). *Computer vision: a modern approach*. prentice hall professional technical reference.
- Sonka, M., Hlavac, V., & Boyle, R. (2013). *Image processing, analysis and machine vision*. Springer.
- Gonzalez, R. C. (2009). *Digital image processing*. Pearson education India.

Semester – I

Course Title: Advance Database management System	**L**	**T**	**P**	**Cr.**
Course Code: MCS1451	**4**	**0**	**0**	**4**

Total Hours: 60

Course 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 on database systems/database techniques.
4. Explain the principles of concurrency control.

Course Content

UNIT-1 **15Hours**

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 **10Hours**

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 **10 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 **10Hours**

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

- Garcia-Molina, H., Ullman, J. D., & Widom, J. (2002). *Database Systems: The Complete Book*. Pearson Education India.
- 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.
- Coronel, C., & Morris, S. (2019). *Database systems: design, implementation and management*. Cengage learning.

Semester – I

Course Title: Machine Learning	L	T	P	Cr.
Course Code: MCS1500	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able 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 **15 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 **15 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 **15Hours**

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:

- Education, P. (2019). *Machine Learning, 1e*. Pearson Education India.
- Theobald, O. (2021). *Machine learning for absolute beginners: a plain English introduction*. Scatterplot press.
- Aamodt, A., & Plaza, E. (1994). Case-based reasoning: Foundational issues, methodological variations, and system approaches. *AI communications*, *7*(1), 39-59..

Semester – I

Course Title: Advanced Database Management System Lab	L	T	P	Cr.
Course Code: MCS1501	0	0	8	4

Total Hours: 60

Course 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.

Semester – I

Course Title: Entrepreneurship Development	L	T	P	Cr.
Course Code: MCS1502	2	0	0	2

Total Hours: 30

Course Learning Outcome: On successful completion of this course, the students will be able to:

1. Assess the commercial viability of new technologies, business opportunities and existing companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills

Course Content

UNIT-I **10Hours**

Introduction to Generic Skills: Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

Managing Self: Knowing Self for Self Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development -Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

UNIT-II **5Hours**

Managing in Team: Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

UNIT-III **10Hours**

Task Management: Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

Problem Solving: Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

UNIT-IV **5Hours**

Entrepreneurship: Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centers (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level. Market Survey and Opportunity Identification (Business Planning)- How to start a small scale industry,

Procedures for registration of small-scale industry, List of items reserved for exclusive manufacture in small-scale industry, Assessment of demand and supply in potential areas of growth, understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures. Project Report Preparation- Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding "Project Report Writing" for small projects.

Transaction Modes:

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

Suggested Readings:

- Desai, Vasant and Urmila Rai 2008. *Entrepreneurship Development and Business Communication*. Himalaya Publishing House, Mumbai.
- Dana, L. P., Etemad, H., & Wright, R. W. (2008). Towards a paradigm of symbiotic entrepreneurship. *International Journal of Entrepreneurship and Small Business, 5*(2), 109-126.
- Hebert, R. F., & Link, A. N. (2009). *A history of entrepreneurship*. New York: Routledge.

Semester – I

Course Title: Soft Computing	L	T	P	Cr.
Course Code: MCS1503	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able 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 **15 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 **15 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 **15 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:

- Goldberg, D. E. (1989). Optimization, and machine learning. *Genetic algorithms in Search*.
- Michalewicz, Z. (1999). Genetic algorithms+ data structures= evolution programs. springer-verlag, 1999. *Google Scholar Google Scholar Digital Library Digital Library*.
- *M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.*
- Rajasekaran, S., & Pai, G. V. (2003). *Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd)*. PHI Learning Pvt. Ltd.
- Sivanandam, S. N., & Deepa, S. N. (2007). *Principles of soft computing (with CD)*. John Wiley & Sons.

Semester – I

Course Title: Cyber Security	L	T	P	Cr.
Course Code: MCS1504	4	0	0	4

Total Hours: 60

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

1. Analyze 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.*

- *Maras, Marie-Helen. (2016). Cyber criminology. Oxford University Press.*

Semester – II

Course Title: Big Data Analytics	L	T	P	Cr.
Course Code: MCS2550	4	0	0	4

Total Hours: 60

Course 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 **15 Hours**

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

UNIT-III **15 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 **15 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

- Minelli, M., Chambers, M., & Dhiraj, A. (2012). *Big data, big analytics: emerging business intelligence and analytic trends for today's businesses*. John Wiley & Sons.
- Bataweel, D. S. (2015). Business intelligence: Evolution and future trends.
- Sadalage, P. J., & Fowler, M. (2013). *NoSQL distilled: a brief guide to the emerging world of polyglot persistence*. Pearson Education.
- White, T. (2012). *Hadoop: The definitive guide*. " O'Reilly Media, Inc."
- George, L. (2011). *HBase: the definitive guide: random access to your planet-size data*. " O'Reilly Media, Inc."
- Hewitt, E. (2010). *Cassandra: the definitive guide*. " O'Reilly Media, Inc."

Semester – II

Course Title: Security Engineering	L	T	P	Cr.
Course Code: MCS2551	4	0	0	4

Total Hours: 60

Course 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 **15Hours**

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 **15 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 **15 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

- Schemes, R., & Co-ordination, R. EE304 POWER SYSTEM PROTECTION AND SWITCHGEAR L T P C.
- Hills, S. M. (2019). School of Engineering. *Electrical Engineering*, *40*, 60.

Semester – II

Course Title: Internet Of Things	L	T	P	Cr.
Course Code: MCS2552	4	0	0	4

Total Hours: 60

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

1. Understand the application areas of IOT.
2. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. Examine the blocks of Internet of Things and characteristics.
4. Use IOT in real world applications.

Course Content

UNIT1 **15 Hours**

Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, v Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT II **15 Hours**

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

Sensors: Sensors in Internet of Things (IoT), **Sensor's characteristics, Dynamic Characteristics,** Types of sensors.

UNIT III **15 Hours**

M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

UNIT IV **15 Hours**

Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages.

IOT Physical Devices & Endpoints: Introduction to IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices.

Transaction Modes

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

Suggested Readings

- Bahga, A., & Madisetti, V. (2014). *Internet of Things: A hands-on approach*. Vpt.
- McEwen, A., & Cassimally, H. (2013). *Designing the internet of things*. John Wiley & Sons.

- Kellmereit, D., & Obodovski, D. (2013). *The silent intelligence: the internet of things*. DnD Ventures.
- Ramon, M. (2014). *Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers* (p. 680). Springer Nature..

Semester – II

Course Title: Mini Project	**L**	**T**	**P**	**Cr.**
Course Code: MCS2553	**0**	**0**	**8**	**4**

Total Hours: 60

Course 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

Semester – II

Course Title: English for Research Paper Writing	L	T	P	Cr.
Course Code: MCS2554	2	0	0	2

Total Hours: 30

Course Learning Outcomes: After completion 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 **15 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 **15 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.
- King, G. (2006). Publication, publication. *PS: Political Science & Politics*, *39*(1), 119-125.

- Highman, N. (1998) Handbook of Writing for the Mathematical Sciences, SIAM. *Highman's book*.

Semester – II

Course Title: Distributed System	L	T	P	Cr.
Course Code: MCS2555	4	0	0	4

Total Hours: 60

Course Course Learning Outcomes: On successful completion of this course, students will be able to:

Total Hours: 60

Course Learning Outcomes: On successful completion of this course, students will be able to:

1.Create a tight coupling between object perception and manipulation

1. Implement and experiment several methods for object grasping.
2. hands-on experience working on a research project.
3. human robot interaction and their application in robotics.

Course Content

UNIT:1 Introduction **15 Hours**

Module 1: Introduction to Cognitive robotics and Human Robot Interaction
Module 2: Smart materials-I
Module 3: Smart materials-II
Module 4: Smart materials-III

UNIT:2 : Brain physiology and neural signal transmission **15 Hours**

Module 1: Architecture of the Brain
Module 2: Architecture of the Brain (Contd.)
Module 3: Nerve cells

UNIT:3 : Neural modeling **15 Hours**

Module 1: Introduction to Synchronization Models
Module 2: Synchronization Models (Contd.)
Module 3: Electroencephalography (EEG)

UNIT:4 : Intelligence architecture **15 Hours**

Module 1: Theories of Intelligence-I
Module 2: Theories of Intelligence-II
Module 3: Kuramoto Model
Module 4: Child-Robot Interaction

Suggested Readings

- Purves, D., Cabeza, R., Huettel, S. A., Platt, M. L., LaBar, K. S., & Woldorff, M. G. (2013). *Principles of cognitive neuroscience* (Vol. 83, No. 3, p. 757). Sunderland, MA: Sinauer Associates.
- Pfeifer, R., & Bongard, J. (2006). *How the body shapes the way we think: a new view of intelligence*. MIT press.

- Raol, J. R., & Ayyagari, R. (2019). *Control systems: classical, modern, and AI-based approaches*. CRC Press.

Semester – III

Course Title: Research Methodology	L	T	P	Cr.
Course Code: MCS3600	4	0	0	4

Total Hours: 60

Course 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 **15 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 **15 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 **15Hours**

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 **15 Hours**

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
- *Kothari C.R., "Research Methodology", New AgePublisher*
- Shergill, G. S., & Nargundkar, R. (2005). Market orientation, marketing innovation as performance drivers: extending the paradigm. *Journal of Global Marketing*, *19*(1), 27-47.
- *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

Semester – III

Course Title: Biometric Security	**L**	**T**	**P**	**Cr.**
Course Code: MCS3601	**4**	**0**	**0**	**4**

Total Hours: 60

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

1. Examine the Mathematical Foundations for Data Security
2. Classify Biometric tool.
3. Analysis the data using data tools
4. Understand the concept of filtering process.

Course Content

UNIT-I **15 Hours**

Biometrics- Introduction- benefits of biometrics over traditional authentication systems – benefits of biometrics in identification systems-selecting a biometric for a system – Applications – Key biometric terms and processes - biometric matching methods – Accuracy in biometric systems.

UNIT-II **15 Hours**

Physiological Biometric Technologies: Fingerprints – Technical description – characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan – Technical description – characteristics - strengths – weaknesses – deployment- Retina vascular pattern

UNIT-III **15 Hours**

Technical description – characteristics - strengths – weaknesses –deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

UNIT-IV **15 Hours**

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

Transaction Modes

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

Suggested Readings

- Sadalage, P. J., & Fowler, M. (2013). *NoSQL distilled: a brief guide to the emerging world of polyglot persistence*. Pearson Education.
- White, T. (2012). *Hadoop: The definitive guide*. " O'Reilly Media, Inc.".
- *O'Reilley, (2012), "*Hadoop Operations*",*.
- *O'Reilley, (2011) , "HBase: The Definitive Guide",*.Lars George.
- *O'Reilley, (2010), "Cassandra: The Definitive Guide",Eben Hewitt.*
- *O'Reilley, (2011), "Programming Pig",* Alan Gates.

Semester – III

Course Title: Dissertation-I	**L**	**T**	**P**	**Cr.**
Course Code: MCS3602	**0**	**0**	**0**	**12**

Total Hours: 180

Course 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.

Semester – III

Course Title: Organizational Behavior	**L**	**T**	**P**	**Cr.**
Course Code: MCS3603	**2**	**0**	**0**	**2**

Total Hours: 30

Course Learning Outcomes: On successful completion of this course, the students will be able to:

1. Understand the conceptual framework of the discipline of OB and its practical applications in the organizational set up.
2. To deeply understand the role of individual, groups and structure in achieving organizational goals effectively and efficiently.
3. To critically evaluate and analyses various theories and models that contributes in the overall understanding of the discipline.
4. To develop creative and innovative ideas that could positively shape the organizations.
5. To accept and embrace in working with different people from different cultural and diverse background in the workplace.

Course Content

UNIT-I **10Hours**

Organizational Behavior: What managers do, Definition of OB, contributing disciplines to OB, challenges and opportunities for OB. Foundations of Individual behavior-biographical characteristics, ability, and learning? Values, Attitudes, Personality and Emotions, Perception

UNIT-II **10Hours**

Motivation: Concept, Theories of Maslow, Herzberg, McClelland, Porter & Lawler Model, Application of Motivation Concept. Job Satisfaction Foundations of Group Behavior: Group formation, development and structure, Group Processes, Group Decision- making Techniques, Work Teams.

UNIT –III

5HoursInterpersonal Skill-Transactional analysis, Life Positions, Johari Window. Leadership: Concept, theories, styles and their application. Power and Politics in Organization.

UNIT –IV **5Hours**

Conflict Management, Stress Management, Crisis Management, Organizational Change & Development, Innovation, Creating a learning Organization, Organizational Culture, Organizational Effectiveness.

Suggested Readings

1. Nelson, Debra L and James C Quick. (2009). Organizational Behavior. Thomson Learning

2. Pareek, Udai. (2007). *Understanding Organizational Behavior*. Oxford University Press, New Delhi.
3. Robbins, S.P. (2012). *Organizational Behavior.* Prentice Hall of India, New Delhi.
4. Hellgiegel, D & J.W. Slocum. (2009). *Organizational Behavior*. Thomson Learning
5. Mcschane. (2014). Organization Behavior. TMH, New Delhi.
6. Luthans, Fred. (2010). *Organizational Behavior.* McGraw Hill, New York.

Semester – IV

Course Title: Dissertation-II	**L**	**T**	**P**	**Cr.**
Course Code: MCS4650	**0**	**0**	**0**	**12**

Total Hours: 180

Course 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.

Semester – IV

Course Title: Value Education	**L**	**T**	**P**	**Cr.**
Course Code: MCS4651	**2**	**0**	**0**	**2**

Total Hours: 30

Course 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*

Semester – IV

Course Title: Digital Forensics	**L**	**T**	**P**	**Cr.**
Course Code: MCS4652	**4**	**0**	**0**	**4**

Total Hours: 60

Course 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 **15 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 **15 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 **15 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(2016), "Practical Digital Forensics",* Packt Publishing.
- *N. Jain, D. Kalbande(2016), Digital Forensic: The Fascinating World of Digital Evidences,* Wiley,.
- *M.J. Britz(2008), Computer Forensics and Cyber Crime: An Introduction,* Pearson.
- *J. Marcella, G. Guillossou(2012), Cyber Forensics: from data to digital intelligence,* Wiley.

Semester – IV

Course Title: Data Science	**L**	**T**	**P**	**Cr.**
Course Code: MCS4653	**4**	**0**	**0**	**4**

Total Hours: 60

Course 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 Hour**

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

Semester – IV

Course Title: Cloud Computing	L	T	P	Cr.
Course Code: MCS4654	4	0	0	4

Total Hours: 60

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 **15 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 **15 Hours**

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

UNIT-IV **15 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
- *Chatterjee, S. R. (1997). Values and Ethics for Organizations: Theory and Practice. The Asia Pacific*