Courses and Credit Scheme

Semester	Core Courses (CC)		Discipline Specific Elective Courses (DSE)		Skill Enhancement Courses (SEC)		Ability Enhancement Courses (AEC)		Open Elective Courses (OEC)		Total Credits
	1	2	3	4	5	6	7	8	9	10	(2+4+6+8+10)
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	6	20	-	-	1	3	1	3	-	-	26
II	4	12	1	4	1	3	1	3	1	4	26
III	1	4	4	12	1	3	1	3	1	4	26
IV	2	18	1	4	-	-	-	-	-	-	22
Sub-total Credits	Core Courses 54		Discipline Specific Elective Courses 20		Skill Enhancement Courses 9		Ability Enhancement Courses 9		Open Elective Courses 8		Total 100
Sub-total Credits Percentage	Core Courses 54%		Discipline Specific Elective Courses 20%		Skill Enhancement Courses 9%		Ability Enhancement Courses 9%		Open Elective Courses 8%		100%

Detailed break-up of Credit Courses

Semester	Core Courses	Discipline Specific Elective Courses	Skill Enhancement Courses	Ability Enhancement Courses	Open Elective Courses	Total Courses
I	CC1/T CC2/T CC3/T CC4/T CC5/P CC6/P		SEC1/T SEC1/T	AEC1/T		8
II	CC7/T CC8/T CC9/P CC10/P	DSC1/T	SEC2/T SEC2/P	AEC2/T	OEC1	8
III	CC11/T	DSC2(i)/T DSC2(ii)/T	SEC3/T SEC3/P	AEC3/T	OEC2	8

		DSC3(i)/T DSC3(ii)/T DSC4(i)/P DSC4(ii)/P DSC5(i)/P DSC5(ii)/P				
IV	CC12/T CC13/P	DSC6(i)/T DSC6(ii)/T				3

M.Sc. Computer Science (Artificial Intelligence and Data Science)

M.Sc. Semester 1

Sr. No.	**Course Code**	**Course Title**	**Max. Marks**			**Credits**
			Int.	Ext.	Total	
1	MDS/1/CC1/T	DATABASE SYSTEMS	30	70	100	4
2	MDS/1/CC2/T	DATA STRUCTURE & ALGORITHMS	30	70	100	4
	MDS/1/CC2/P	LAB DATA STRUCTURES &ALGORITHMS	-	50	50	2
3	MDS/1/CC3/T	DATA MINING	30	70	100	4
4	MDS/1/CC3/P	LAB DATA MINING	-	50	50	2
5	MDS/1/CC4/T	ARTIFICIAL INTELLIGENCE	30	70	100	4
6	MDS/1/AEC1/T	PROFESSIONAL ETHICS	25	50	75	3
7	MDS/1/SEC1/T	DIGITAL FLUENCY	15	35	50	2
8	MDS/1/SEC1/P	DIGITAL FLUENCY LAB	-	25	25	1
Sub Total Semester I			160	490	650	26

M.Sc. Semester 2

Sr. No.	**Course Type**	**Course Title**	**Max. Marks**			**Credits**
			Int.	Ext.	Total	
1	MDS/2/CC5/T	DATA SCIENCE	30	70	100	4

2	MDS/2/CC5/P	LAB DATA SCIENCE	-	50	50	2
3	MDS/2/CC6/T	PROGRAMMING WITH PYTHON	30	70	100	4
4	MDS/2/CC6/P	LAB PYTHON	-	50	50	2
5	MDS/2/DSC1(i)/T	BIG DATA ANALYTICS	30	70	100	4
	MDS/2/DSC1(ii)/T	SOCIAL NETWORK ANALYTICS				
6	MDS/2/AEC2/T	CONSTITUTION OF INDIA	25	50	75	3
7	MDS/2SEC2/T	CYBER SECURITY	15	35	50	2
8	MDS/2/SEC2/P	CYBER SECURITY LAB	-	25	25	1
9	MDS/OEC1/T		30	70	100	4
Sub Total Semester II			160	490	650	26

M.Sc. Semester 3

Sr. No.	**Course Type**	**Course Title**	**Max. Marks**			**Credits**
			Int.	Ext.	Total	
1	MDS/3/CC7/T	RESEARCH METHODLOGY	30	70	100	4
2	MDS/3/DSC2(i)/T	EVOLUTIONARY ALGORITHM	30	70	100	4
	MDS/3/DSC2(ii)/T	MACHINE LEARNING				
3	MDS/3/DSC2(i)/P	LAB EVOLUTIONARY ALGORITHMS		50	50	2
	MDS/3/DSC2(ii)/P	LAB MACHINE LEARNING				
4	MDS/3/DSC3(i)/T	PROGRAMMING WITH MATLAB	30	70	100	4
	MDS/3/DSC3(ii)/T	PROGRAMMING WITH R				
5	MDS/3/DSC3(i)/P	LAB MATLAB		50	50	2
	MDS/3/DSC3(ii)/P	LAB R PROGRAMMING				
6	MDS/3/AEC3/T	HEALTH AND	25	50	75	3

		FITNESS				
7	MDS/3/SEC3/T	DIGITAL MARKETING	15	35	50	2
8	MDS/3/SEC3/P	LAB DIGITAL MARKETING		25	25	1
9	MDS/3/OEC2/T		30	70	100	4
Sub Total Semester III			160	490	650	26

M.Sc. Semester 4

Sr. No.	Course Type	Course Title		Max Marks			Credits
				Int.	Ext.	Total	
1	MDS/4/CC8/T	IOT & CLOUD COMPUTING		30	70	100	4
2	MDS/4/DSC4(i)/T	SOFT COMPUTING		30	70	100	4
	MDS/4/DSC4(ii)/T	DEEP LEARNING					
3	MDS/4/CC9/P	RESEARCH PROJECT	Proposal Seminar	75	-	75	3
			Internal Assessment	75	-	75	3
			Project Documentation	-	100	100	4
			Project Viva	-	100	100	4
Sub Total Semester IV				210	340	550	22

Program Total Credits = 100

Courses offered

Course Name	Course Title	Credits
Core Courses		
MDS/1/CC1/T	Database Systems	4
MDS/1/CC2/T	Data Structure & Algorithms	4
MDS/1/CC3/T	Data Mining	4
MDS/1/CC4/T	Artificial Intelligence	4

MDS/1/CC2/P	Lab Data Structure & Algorithms	2
MDS/1/CC3/P	Lab based on Data Mining	2
MDS/2/CC5/T	Data Science	4
MDS/2/CC6/T	Programming with Python	4
MDS/2/CC5/P	Lab Data Science	2
MDS/2/CC6/P	Lab Python	2
MDS/3/CC7/T	Research Methodology	4
MDS/4/CC8/T	IoT& Cloud Computing	4
MDS/4/CC9/P	Research Project	14
	Total	**54**
Discipline Specific Elective Courses		
MDS/2/DSC1(i)/T	Big Data Analytics	4
MDS/2/DSC1(ii)/T	Social Network Analytics	4
MDS/3/DSC2(i)/T	Evolutionary Algorithm	4
MDS/3/DSC2(ii)/T	Machine Learning	4
MDS/3/DSC3(i)/T	Programming with MATLAB	4
MDS/3/DSC3(ii)T	Programming with R	4
MDS/3/DSC2(i)/P	Lab Evolutionary Algorithms	2
MDS/3/DSC2(ii)/P	Lab Machine Learning	2
MDS/3/DSC3(i)/P	Lab MATLAB	2
MDS/3/DSC3(ii)/P	Lab R	2
MDS/4/DSC4(i)/T	Soft Computing	4
MDS/4/DSC4(ii)/T	Deep Learning	4
	Total	**20**
Ability Enhancement Courses		
MDS/1/AEC1/T	Professional Ethics	3
MDS/2/AEC2/T	Constitution of India	3
MDS/3/AEC3/T	Health & Fitness	3
	Total	**9**
Skill Enhancement Courses		
MDS/1/SEC1/T	Digital Fluency	2
MDS/1/SEC1/P	Digital Fluency LAB	1
MDS/2/SEC2/T	Cyber Security	2
MDS/2/SEC2/P	Cyber Security	1
MDS/3/SEC3/T	Digital Marketing	2
MDS/3/SEC3/P	Digital Marketing LAB	1
	Total	**9**
Open Elective Courses		
MDS/2/OEC1/T		4
MDS/3/OEC2/T		4
	Total	**8**

MDS/1/CC1/T: Database Systems							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: Final-Term examination shall cover the whole content of the course. Total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective type questions from the complete syllabus. In addition to the compulsory first question there shall be four units in the question paper each consisting of two questions. Students will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with the concepts, models, architecture and applications of database systems.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:** schema architecture, ER diagrams, EER model, functional dependencies, normal forms, data types, views in SQL, concurrency control techniques, database security issues, semantic data models, and client server architecture.
CO2	**describe:** ER diagram, relational model, EER model, functional dependencies, normal forms, SQL constraints and views, recovery algorithm.
CO3	**apply:** inheritance, SQL queries, constraints, recovery techniques. justify: architecture, relational schema, recovery technique and data model shall be better suited in different situations.
CO4	**differentiate:** subclass and superclass, specialization and generalization, functional dependencies, normal forms.

CO-PO Mapping Matrix

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	1	3	1	1	1	-	3	-	-	2	-	-
CO	2	1	1	3	1	-	3	-	-	2	-	-

2												
CO 3	3	1	1	3	3	-	3	-	-	2	-	-
CO 4	2	1	1	3	1	-	3	-	-	2	-	-
CO 5	2	1	3	1	3	-	3	-	-	2	-	-
Avg	2	1.4	1.4	2.2	1.5	-	3	-	-	2	-	-

Course Content
MDS/1/CC1/T: Database Systems

Unit I	**Basic concepts:** a historical perspective, file system vs. DBMS, characteristics of the database approach, abstraction and data integration, database users, advantages and disadvantages of a DBMS, implication of database approach. Database system concepts and architecture- data models, schemas and instances, DBMS architecture and data independence database languages & interfaces, DBMS functions and component modules.
Unit - II	**Entity-relationship model:** entity types, entity sets, attributes & keys, relationships, relationship types, roles and structural constraints, design issues, weak entity types, E-R diagrams, design of an E-R database schema. Conventional data models- an overview of network and hierarchical data models. relational data model- relational model concepts, integrity constraints over relations, relational algebra – basic operations.
Unit – III	**SQL:** data definition, constraints, & schema changes in SQL, insert, delete & update statements in SQL, view in SQL, specifying constraints and indexes in SQL, queries in SQL. **ORACLE:** a historical perspective, basic structure, database structure and its manipulation in Oracle, storage organization in Oracle programming, Oracle applications. **Relational database design:** functional dependencies, decomposition, desirable properties of decomposition, normal forms based on primary keys (1 NF, 2 NF, 3 NF and BCNF).

	Practical database design: role of information systems in organizations, database design process, physical database design in relational databases.
Unit – IV	**Transaction processing concepts:** introduction to transaction processing, transaction & system concepts, properties of transaction, schemes and recoverability, serializability of schedules. **Concurrency control techniques:** locking techniques, timestamp ordering, multiversion techniques, optimistic techniques. **Recovery techniques:** recovery concepts, recovery techniques in centralized DBMS. **Database security:** introduction to database security issues.
Text/Reference Books	
Text Books	1. Elmasri & Navathe, "Fundamentals of Database System", 3e, Addison Wesley, New Delhi. 2. Korth & Silberschatz, "Database System Concept", 4e, McGraw Hill International.
Reference Books	1. C.J. Date, "An Introduction to Database System", 7e, Addison Western. 2. Abbey Abramson, Cory, "ORACLE SI-A Beginner's Guide", Tata McGraw Hill Publishing Company Ltd.

MDS/1/CC2/T: Data Structures & Algorithms							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with various types of data structure and different techniques to implement the data structures and their real-life applications.

Course Outcomes	At the end of this course, the student will be able to:

CO1	**define:** abstract data types, algorithms, complexity of algorithms, linear data structures, non-linear data structures, searching, sorting, hashing.
CO2	**give:** original examples of : data structures and its types; explain: sorting techniques, searching methods, hashing and collision resolution techniques.
CO3	**calculate:** (complexity of algorithm). use array , stack, queue, linked list, tree, graph, linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function to solve given problems.
CO4	**differentiate:** data structure, searching techniques, sorting techniques, hash functions; analyze: time and space complexity.
CO5	**evaluate:** the complexity of linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function and select the best one for a given problem.

CO-PO Mapping Matrix

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO 3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.5**	**-**	**3**	**-**	**-**	**-**	**-**	**-**

Course Content
MDS/1/CC2/T: Data Structures & Algorithms

Unit – I	**Data structure and algorithm preliminaries:** Definitions, time and space analysis of algorithms, time-space tradeoffs, mathematical notation and functions, asymptotic notations for complexity of algorithms, recursion, divide and conquer strategy.
Unit – II	**Linear data structures**: abstract data types, array-based implementation, **Stack:** operations and application of stacks. **Queues:** operation on queues, circular queue, priority queues and de-queue, **Linked list:** implementation of linked list, header linked list for polynomial manipulation.
Unit – III	**Non-linear data structures:** **Trees:** binary tree, tree traversals, binary search tree, threaded binary tree, AVL tree, B-tree, B+ tree, heap and its applications, Huffman coding. **Graph:** representation of graphs, types of graphs, graph traversals, topological sort, minimum spanning trees, Kruskal and Prim's algorithm, application of graphs.
Unit – IV	**Searching, sorting and hashing techniques:** **Searching:** linear search, binary search. **Sorting:** bubble sort, selection sort, insertion sort, radix sort, shell sort, merge sort, quick sort, heap sort, **Hashing:** hash functions, open addressing, chaining, rehashing.
Text/Reference Books	
Text Books	1. Seymour Lipschutz, "Data Structures (Schaum's Outline Series)", McGraw-Hill Book Company. 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, 2002.
Reference Books	Tanenbaum A.M., Langsam Y, Augenstein M.J., "Data Structures using C & C++", Prentice Hall of India, 2002. SartajSahni, "Data Structures, Algorithms and Applications in C++", 2e, Universities Press Orient Longman Pvt. Ltd.

MDS/1/CC3/T: Data Mining							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: Final-Term examination shall cover the whole content of the course. Total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective type questions from the complete syllabus. In addition to the compulsory first question there shall be four units in the question paper each consisting of two questions. Students will attempt one question from each unit in

addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different concepts of data mining namely, OLAP, Association rule mining, classification and prediction.

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** the concepts of data mining, data pre-processing, outliers, data warehouse ,OLAP , association rule mining, data classification prediction and cluster Analysis.
CO2	**describe:** key process of data mining ,data warehousing, OLAP, data warehousing to data mining , association rule, classification and prediction methods.
CO3	**apply:** OLAP technology and association rules. use: decision induction, Bayesian and back prorogation classification methods.
CO4	**differentiate:** operational database systems and data warehousing, single dimensional and multidimensional association rules, and between various data mining classification methods.
CO5	**evaluate:** data mining and data warehouse, OLAP technology, single and multidimensional association rule.

CO-PO Mapping Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**-**	**-**	**1**	**-**	**-**

Course Content MDS/1/CC3/T: Data Mining	
Unit I	**Data Mining:** Introduction: Motivation, Importance, Knowledge discovery process, data mining, kind of data, Functionalities, interesting patterns, classification of data mining system, Major issues, Data Mining Primitives. Data Pre-processing: Data cleaning, Data Integration and transformation, Data reduction, Discretization and concept hierarchy generation. Data visualization. Outliers, Types of Outliers and Challenges of Outlier Detection.
Unit - II	**Data warehouse and OLAP Technology for data mining:** data warehouse, difference between operational database systems and data warehouse, A Multidimensional Data Model, Data warehouse Architecture, Data warehouse Implementation, data warehousing to data mining, Data warehouse usage.
Unit - III	**Association Rule Mining:** Mining single-dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, constraint-based association Mining.
Unit - IV	**Data Mining Classification and Prediction:** issues regarding classification and prediction, classification by decision induction, Bayesian classification, classification by back propagation, classification based on concepts from association rule mining and other classification methods. **Cluster Analysis:** What is Cluster Analysis, Types of Data in Cluster Analysis, Applications and Trends in Data Mining.
Text/Reference Books	
Text Books.	1. Ale Berson, Stephen Smith, Korth Theorling, "Data Mining", Tata McGraw Hill. 2. Pieter Adriaans and Dolf Zantinge, "Data Mining", Addison-Wesley Longman. 3. Sam Anahory, "Data Warehousing in the Real World", Addison-Wesley Longman.
Reference Books	1. Chanchal Singh, "Data Mining and Warehousing", Wiley.

MDS/1/CC4/T: Artificial Intelligence							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/

							Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide an understanding of Artificial Intelligence techniques and their applications. Various search techniques and expert systems along with other components of artificial intelligence in computer science will be covered.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:** artificial intelligence terms, types of search strategy, production system, knowledge representation, learning techniques and genetic algorithm terminologies.
CO2	**explain:** the types and properties of search algorithm, predicate calculus, knowledge representation and explore the theories that demonstrate intelligent behavior including intelligent editor, learning by induction and dealing with uncertainty.
CO3	**use:** search strategy/genetic algorithm/ fuzzy logic and learning technique.
CO4	**classify types of:** search strategy, production system, learning, operator of genetic algorithm, knowledge representation and approaches that deal with uncertainty.
CO5	**compare and select types of:** search strategy, production system, learning, operator of genetic algorithm, knowledge representation and approaches that deal with uncertainty.

CO-PO Mapping Matrix

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**2**	**-**	**-**
CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**2**	**-**	**-**

CO 3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**2**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.5**	**-**	**3**	**-**	**-**	**2**	**-**	**-**

Course Content **MDS/1/CC4/T: Artificial Intelligence**	
Unit – I	**Introduction:** background and history, overview of AI applications areas. The predicate calculus: syntax and semantic for propositional logic and FOPL, clausal form, inference rules, resolution and unification. Knowledge representation: network representation, associative network & conceptual graphs, structured representation, frames & scripts.
Unit – II	**Search strategies:** strategies for state space search, data-driven and goal driven search, **Search algorithms:** uninformed search (depth-first, breadth-first, depth-first with iterative deepening) and informed search (hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, properties of search algorithms, admissibility, monotonicity, optimality, dominance.
Unit - III	**Production system:** types of production system-commutative and non-commutative production systems, decomposable and non-decomposable production systems, control of search in production systems. **Rule-based expert systems:** architecture, development, managing uncertainty in expert systems, Bayesian probability theory, Stanford certainty factor algebra, nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.
Unit – IV	**Knowledge acquisition:** types of learning, learning by automata, intelligent editors, learning by induction. **Genetic algorithms:** problem representation, encoding schemes, operators: selection, crossover, mutation, replacement etc.
Text/Reference Books	
Text Books	1. George F. Luger, "Artificial Intelligence", Pearson Education.

	2. Dan W. Patterson. "Introduction to Artificial Intelligence and Expert System", PHI.
Reference Books	1. Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence" Addison Wesley. 2. Wils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing house. 3. Jackson Peter, "Introduction to Expert Systems", 3e, Addison Wesley, 2000.

MDS/1/CC2/P: Lab- Data Structures & Algorithms

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50		3 Hours	TEE/MTE/ Assignment/Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva-voce exam.

Course Objectives: The objective of this course is to get the students hands-on practice with data structure concepts covered in course **MDS/1/CC2/T** using (c / c++ / java).

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:** abstract data types, algorithms, complexity of algorithms, linear data structures, non-linear data structures, searching, sorting, hashing.
CO2	**give:** original examples of: data structures and its types; explain: sorting techniques, searching methods, hashing and collision resolution techniques.
CO3	**calculate:** (complexity of algorithm). use array , stack, queue, linked list, tree, graph, linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function to solve given problems.
CO4	**differentiate:** data structure, searching techniques, sorting techniques, hash functions; analyze: time and space complexity.
CO5	**evaluate:** the complexity of linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function and select the best one for a given problem.
CO6	**develop:** programs based on application of stack, queue, searching and sorting.

CO-PO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	3	1	1	1	-	3	-	-	-	-	-
CO 2	2	1	1	3	1	-	3	-	-	-	-	-
CO 3	3	1	1	3	3	-	3	-	-	-	-	-
CO 4	2	1	1	3	1	-	3	-	-	-	-	-
CO 5	2	1	3	1	3	-	3	-	-	-	-	-
Avg	2	1.4	1.4	2.2	1.5	-	3	-	-	-	-	-

MDS/1/CC3/P: Lab Data Mining							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50		3 Hours	TEE/MTE/ Assignment/ Attendance
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva-voce exam.							
Course Objectives: The objective of this course is to get the students hands-on practice with data mining concepts covered in course **MDS/1/CC3/T**.							

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** the concepts of data mining, data pre-processing, outliers, data warehouse ,OLAP , association rule mining, data classification prediction and cluster Analysis.
CO2	**describe:** key process of data mining ,data warehousing, OLAP, data warehousing to data mining , association rule, classification and prediction methods.
CO3	**apply:** OLAP technology and association rules. use: decision induction, Bayesian and back prorogation classification methods.
CO4	**differentiate:** operational database systems and data warehousing, single dimensional and multidimensional association rules, and between various data mining classification methods.
CO5	**evaluate:** data mining and data warehouse, OLAP technology, single and multidimensional association rule.
CO6	**demonstrate:** classification rule, association rule and clustering.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**-**	**-**	**1**	**-**	**-**

MDS/1/AEC1/T Professional Ethics

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Ability Enhancement Course	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to enable the students to create awareness on Ethics and Human Values, instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:** personal and professional ethics, moral developments, deontology, utilitarianism, virtue Theory and rights Theory, professional practices, global issues in professional ethics.
CO2	**explain:** the basic ethical principles, virtue theory, right theory, casuist theory
CO3	**use:** professional practice in their professional life.
CO4	**classify:** moral absolution ,moral pluralism, moral rationalism.
CO5	**compare and select:** ethics according to profession.

CO-PO Mapping Matrix for Course MDS/1/AEC1/T

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**

CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**1**	**-**	**2**	**-**	**-**
CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**2**	**-**	**2**	**-**	**-**
CO 3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**2.4**	**-**	**2**	**-**	**-**

Course Content
MDS/1/AEC1/T Professional Ethics

Unit – I	**Basic Concepts:** Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.
Unit – II	**Basic Theories:** Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

Unit - III	**Professional Practices:** Professions and Norms of Professional Conduct Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walkway Collapse.
Unit – IV	**Global issues in Professional Ethics:** Introduction Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; BioEthics, Intellectual Property Rights.
Text/Reference Books	
Text Books	1. R. Subramanian, "Professional Ethics", Oxford University Press, 2015. 2. Caroline Whitbeck, "Ethics in Engineering Practice & Research", 2e, Cambridge University Press, 2015.
Reference Books	1. Charles E Harris Jr, Michael S Pritchård, Michael J Rabins, "Engineering Ethics: Concepts and Cases", 4e, Cengage learning, 2015. 2. Manuel G Velasquez, "Business Ethics concepts & Cases", 6e, PHI, 2008.

MDS/1/SEC1/T Digital Fluency

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Skill Enhancement Course	02	02	Lecture	35	15	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to understand the basic concepts of computers, applications of the internet, virtual learning environments and digital editing.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define**: the basic computer concepts, internet applications, virtual learning environment systems, effective usage of virtual learning environment.
CO2	**explain:** the effective usage of a virtual learning environment, features of an LMS / VLE / CMS and digital editing tools.
CO3	**use:** of multimedia applications in education, multimedia development Environment and usage of virtual learning environment
CO4	**classify:** multimedia tools, virtual learning environment and digital editing tools.
CO5	**compare and select types of:** multimedia tools, virtual learning environment and digital editing tools.

CO-PO Mapping for Course MDS/1/SEC1

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-

Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**2.4**	**-**	**2**	**-**	**-**

Course Content
MDS/1/SEC1/T Digital Fluency

Unit – I	**Basic Computer Concepts and Operations:** Basic Computer Concepts and Operations, Computers in Daily Activities, Computer Components, Productivity suites for teaching and learning, Educational Programs and their uses, Basic File Handling Operations, Technology Trends in Education.
Unit – II	**Internet Fundamentals and Applications:** Using the Internet, Internet Applications, Google Advanced Search, Web 2.0 applications for learning, Using Google forms, Internet Ethics and Security.
Unit - III	**Virtual Learning Environments:** Basics of Virtual Learning Environment, Virtual Learning Environment systems, Effective usage of Virtual Learning Environment, Investigate the Features of an LMS / VLE / CMS, Example of a Virtual Learning Environment. **Multimedia Fundamentals:** Multimedia Elements, Multimedia Applications in Education, Multimedia Development Environments, basic Multimedia Production.
Unit – IV	**Digital Editing:** Learning Objectives, Digital Editing Overview, Digital Content and Media, Digital editing tools, Editing Digital Text, Editing Digital Audio. **Importance of the following:** Effective Communication Skills, Creative Problem Solving & Critical Thinking, Collaboration and Teamwork Skills , Innovation & Design Thinking, Use of tools in enhancing skills.
Text/Reference Books	
Text Books	1. S P Sajjan, "Digital Fluency 2021", Ekalavya e-Educate
Reference Books	1. "Digital Fluency Book", Cambridge Publishing Company Online. Delivered by Amazon.

MDS/1/SEC1/P Digital Fluency

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Skill Enhancement Course	01	02	Lecture	25		3 Hours	TEE/MTE/ Assignment / Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to understand the basic concepts of computers, applications of the internet, virtual learning environments and digital editing.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define**: the basic computer concepts, internet applications, virtual learning environment systems, effective usage of virtual learning environment.
CO2	**explain:** the effective usage of a virtual learning environment, features of an LMS / VLE / CMS and digital editing tools.
CO3	**use:** of multimedia applications in education, multimedia development Environment and usage of virtual learning environment
CO4	**classify:** multimedia tools, virtual learning environment and digital editing tools.
CO5	**compare and select types of:** multimedia tools, virtual learning environment and digital editing tools.

CO-PO Mapping for Course MDS/1/SEC1

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**1**	**-**	**2**	**-**	**-**

CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**2**	**-**	**2**	**-**	**-**
CO 3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**2.4**	**-**	**2**	**-**	**-**

MDS/2/CC5/T Data Science

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with the concepts and processes of Data Science including collection, filtering, processing, analysis and visualization.

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** data science process, classification of data, big data, web data, sampling, data analysis techniques-correlation, regression, mean, mode, kurtosis, Bayesian inference etc., neural network, fuzzy logic, rule of mining, hadoop, hive, cloud database, and visualization.
CO2	**understand and describe:** graphical representation of data, storage and retrieval of data, evolution of analytic scalability, sampling distribution, data analysis techniques, Bayesian model and network, induction rule, neural network, fuzzy logic, data mining techniques, data analysis framework and visualization.
CO3	**use:** data science process, modern data analytic tools, statistical concepts, data analysis techniques, Bayesian network, induction rule, fuzzy logic, data mining techniques, hadoop file system, hive, S3, cloud database, inference and visualization.
CO4	**categorize:** analytic processes and tools, analysis, reporting, sampling and resampling, data analysis techniques, linear and non-linear time series, sequential, temporal and spatial mining, egonets systems and application.
CO5	**choose:** data science process, data storage, data analytic tools and processes, sampling method, data analysis technique, time series, mining techniques, visual data analysis framework and technique suitable in given situation.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-
CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-
Avg	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

Course Content MDS/2/CC5/T Data Science	
Unit I	**Introduction to Data Science:** data science process, exploratory data analysis, collection of data, graphical presentation of data, classification of data, storage and retrieval of data, big data, challenges of conventional systems, web data, evolution of analytic scalability, analytic processes and tools, analysis vs reporting, modern data analytic tools; **Statistical Concepts:** sampling distributions, re-sampling, statistical inference, prediction error.
Unit – II	**Data Analysis:** Correlation, regression, probability, Conditional probability, random variables, analysis using mean, median, mode, standard deviation, skewness, kurtosis, regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods; Analysis of Time Series: linear systems analysis, nonlinear dynamics.
Unit – III	**Data Mining Techniques:** Rule induction: neural networks: learning and generalization, competitive learning, principal component analysis and neural networks. **Fuzzy Logic**: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods, neuro fuzzy modeling. **Association Rule Mining:** clustering, outlier analysis, sequential pattern mining, temporal mining, spatial mining, web mining.
Unit – IV	**Data Analysis Frameworks and Visualization:** Map Reduce, Hadoop, Hive, sharding, NoSQL databases, cloud databases, S3, Hadoop Distributed File Systems, visualizations, visual data analysis techniques, interaction techniques, social network analysis, collective inferencing, Egonets systems and applications.
Text/Reference Books	
Text Books.	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
Reference Books	1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons, 2012. 2. Jiawei Han, MichelineKamber, "Data Mining Concepts and Techniques", 2e, Elsevier. 3. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Publishers, 2013. 4. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly Publishers, 2013. 5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to

	Data Science and its Applications“, Wiley Publishers, 2014.

MDS/2/CC6/T Programming with Python							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objectives of this course is to get the students familiar with basic concepts of Python programming, decision making and functions, file handling and object oriented programming concepts, database programming and to implement machine learning concepts.

Course Outcomes	At the end of this course, the student will be able to
CO1	**define:** installations, working, structures, control statements, operators, lists, object oriented programming concepts, python libraries.
CO2	**explain:** conditional & control statements ,strings, OOPs ,file handling concepts ,libraries and packages of python programming.
CO3	**use:** various python libraries such as numpy, matplotlib, pandas. apply: python programming constructs to solve real world problems.
CO4	**categorize:** data types, dictionaries, conditional & control statements, functions, python libraries.
CO5	**compare:** data types, dictionaries,conditional & control statements, functions, python libraries.
CO6	**design:** basic and advanced applications in python.

CO-PO Mapping Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	**1**	**3**	**1 1**	**1**	**1**	**-**	**3**	**1**	**-**	**-**	**-**	**-**
CO2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**2**	**-**	**-**	**-**	**-**
CO3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**1**	**3**	**1**	**-**	**3**	**3**	**-**	**-**	**-**	**-**
CO5	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**
CO6	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**
Avg	**2.5**	**2**	**1.3**	**2.6**	**2**	**-**	**3**	**2.5**	**-**	**-**	**-**	**-**

Course Content
MDS/2/CC6/T Programming with Python

Unit – I	**Installation and Working with Python:** Using Help, Structure of a Python Program, Control flow, Interpreter shell, Tokens, Identifiers, Reserved keywords, Literals, Variables, Python basic Operators, Declaring and using Numeric data types: int, float, complex, using string data type. Python Casting, Scope of a Variable, Working with: String, List, Tuples and Dictionaries.
Unit – II	**Conditional blocks:** Conditional blocks using if, else and elif, For loops in python, While loops, Continue, Break and Else, organizing python codes using functions. **Modules:** Creating Modules, using Modules and Built-in Modules. **Packages:** Package Types, Importing Package, Viewing Package Content and Documentation. Powerful Lambda Function in python. **Programming:** Using Functions, Modules and Packages.
Unit – III	**Object Oriented Programming:** Concept of Class, Object and Instances, Constructor, Class Attributes and Destructors, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Overloading Operators, Data Hiding, Exception Handling, Programming using Oops concepts. **File Handling:** Creating, Opening, Closing, Writing & Reading File Content, Deleting a File. Programming using file operations.

Unit – IV	**Python NumPy:** Array Slicing, Array Indexing, Data Types, Array Shape & Reshape, Array Join, Array Split, Random. **Python Pandas:** Data Frames, Read CSV, Analyzing Data and Cleaning Data. **Python Matplotlib:** Line, Grid, Scatter, Bars, Histograms and Pie Charts. **Machine Learning:** Mean, Median, Mode, Standard Deviation, Percentile, Normal Data Distribution, Scatter Plot and Linear Regression.
Text/Reference Books	
Text Books	1. Chun, J Wesley, "Core Python Programming", 2e, Pearson, 2007. 2. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", McGraw Hill Education, 2016.
Reference Books	1. Barry and Paul, "Head First Python", 2e, O Reilly, 2010. 2. Lutz and Mark, "Learning Python", 4e, O Reilly, 2009

MDS/2/DSC1(i)/T: Big Data Analytics

Course Type	Course Credits	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Optional Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different concepts of Big Data and their realization/implementation using Hadoop and Map Reduce tool sets.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: Big Data and Hadoop, digital data, Apache Hadoop, analyzing Data with Unix tools and Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy, HDFS, Hadoop Ecosystem, Pig, Hive shell and services, HBasics, Big SQL.
CO2	understand and describe: Big Data and Hadoop, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy, Hadoop Distributed File System, command line interface, job scheduling, shuffle and sort, task execution, Hadoop Ecosystem, Pig, HiveQL, Hbase.
CO3	apply and use: Apache Hadoop, HDFC,HBasic, Big Data and Hadoop,HDFS

	command line interface, Hadoop file system interfaces, data flow, Hive services.
CO4	classify: Big Data and Hadoop, Big Data Analytics, Apache Hadoop, HDFS ,Hive shell, Hive services.
CO5	Compare: the feature set of Pig, Hadoop, HDFS.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**-**	**-**	**1**	**-**	**-**

Course Content
MDS/2/DSC1(i)/T: Big Data Analytics

Unit -I	**Introduction to Big Data and Hadoop:** Types of digital data, introduction to Big Data,Vs of Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy,Big Data applications.
Unit–II	**HDFS (Hadoop Distributed File System):**The design of HDFS, HDFS concepts, command line interface, Hadoop file system interfaces, data flow, data ingest with flume and Sqoop and Hadoop archives. **Hadoop I/O:** compression, serialization, Avro and file-based data structures.
Unit –III	**Map Reduce:** Anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types and formats, Map Reduce features.
Unit –IV	**Hadoop Ecosystem:** Introduction,features.

	Pig: Introduction to Pig, execution modes of Pig, comparison of Pig with databases, grunt, Pig latin, user defined functions, data processing operators. **Hive:** Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions. **Hbase:** HBasics, concepts, clients, example, Hbase Vs RDBMS. **Big SQL:** Introduction
Text/Reference Books	
Text Books	1. Tom White, "Hadoop: The Definitive Guide", 3e, O'reilly Media, 2012. 2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", Wiley 2015. 3. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", MC Press.
Reference Books	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications. 3. Anand Rajaraman and Jeffrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012. 4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons, 2012.

MDS/2/DSC1(ii)/T: Social Network Analytics

Course Type	Course Credits	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Optional Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to understand the concept of Social Media Analytics, NLP techniques, analytics of Facebook, collection and analysis of data related to social media.

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** Social Media Analytics, Web analytics tools, Network Analysis(LinkedIn, Instagram, YouTube Twitter etc. Google analytics).
CO2	**understand and describe:** Link Prediction, Collective Classification,

	Applications in Advertising and Game Analytics.
CO3	**apply and use:** techniques of Processing and Visualizing Data, Natural Language Processing Techniques for Micro-text Analysis.
CO4	**classify:** Social Media Analytics, Web analytics and Facebook Analytics.
CO5	**compare:** techniques of Processing and Visualizing Data, Natural Language Processing Techniques for Micro-text Analysis.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
CO5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**-**	**-**	**1**	**-**	**-**

Course Content
MDS/2/DSC1(ii)/T: Social Network Analytics

Unit-I	**Introduction to Social Media Analytics (SMA):** Social media landscape, Need for SMA; SMA in small organizations, SMA in large organizations, application of SMA in different areas. **Network fundamentals and models:** The social networks perspective - nodes, ties and influencers, social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.
Unit–II	**Making connections:** Link analysis. Random graphs and network evolution. **Social contexts:** Affiliation and identity. **Web analytics tools:** Click stream analysis, A/B testing, online surveys, Web

	crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis.
Unit–III	**Facebook Analytics:** Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)
Unit–IV	**Data Collection and Analysis:** Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.
Text/Reference Books	
Text Books	1. Matthew Ganis, Avinash Kohirkar, "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media", Pearson.
Reference Books	1. Jim Sterne, Jim Sterne, "Social Media Metrics: How to Measure and Optimize Your Marketing", Wiley. 2. Oliver Blanchard, "Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech)", Que Publishing.

MDS/2/CC5/P: Lab Data Science

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50		3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva-voce exam.

Course Objectives: The objective of this course is to get the students hands-on practice with data science concepts covered in course **MDS/2/CC5/T**.

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** data science process, classification of data, big data, web data, sampling, data analysis techniques-correlation, regression, mean, mode, kurtosis, Bayesian inference etc., neural network, fuzzy logic, rule of mining, hadoop, hive, cloud database, and visualization.
CO2	**understand and describe:** graphical representation of data, storage and retrieval of data, evolution of analytic scalability, sampling distribution, data analysis techniques, Bayesian model and network, induction rule, neural network, fuzzy logic, data mining techniques, data analysis framework and visualization.
CO3	**use:** data science process, modern data analytic tools, statistical concepts, data analysis techniques, Bayesian network, induction rule, fuzzy logic, data mining techniques, hadoop file system, hive, S3, cloud database, inference and visualization.
CO4	**categorize:** analytic processes and tools, analysis, reporting, sampling and resampling, data analysis techniques, linear and non-linear time series, sequential, temporal and spatial mining, egonets systems and application.
CO5	**choose:** data science process, data storage, data analytic tools and processes, sampling method, data analysis technique, time series, mining techniques, visual data analysis framework and technique suitable in given situation.
CO6	**develop:** application using concepts of data science.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-
CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-

Avg	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

MDS/2/CC6/P: Lab Programming with Python							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50		3 Hours	TEE/MTE/ Assignment/Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva-voce exam.

Course Objectives: The objective of this course is to get the students hands-on practice with python programming concepts covered in course **MDS/2/CC6/T**.

Course Outcomes	At the end of this course, the student will be able to
CO1	**define:** installations, working, structures, control statements, operators, lists, object oriented programming concepts, python libraries.
CO2	**explain:** conditional & control statements ,strings, OOPs ,file handling concepts ,libraries and packages of python programming.
CO3	**use:** various python libraries such as numpy, matplotlib, pandas. apply: python programming constructs to solve real world problems.

CO4	**categorize:** data types, dictionaries, conditional & control statements, functions, python libraries.
CO5	**compare:** data types, dictionaries, conditional & control statements, functions, python libraries.
CO6	**design:** basic and advanced applications in python.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1 1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Avg	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-

MDS/2/AEC2/T Constitution of India							
Course Type	Course Credits	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		

Compulsory Theory	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The course aims at providing complete knowledge about the framework that demarcates fundamental political structure, procedure, powers.

Course Outcomes	At the end of this course, the student will be able to :
CO1	**define:** duties of government institutions and sets out fundamental rights,directive principles and duties of citizens.
CO2	**understand and describe:** duties of government institutions and sets out fundamental rights,directive principles and duties of citizens,directive principles of states policy, enforcement of directive principles(article 36-51), fundamental duties(article 51 A), extent of liability of the state(article 299,300), right to property(article 300-A).
CO3	**use:** Right to Life & Personal Liberty (Article 21) Protection in case of arrest & Detention (Article 22) Right Against Exploitation (Article 23, 24) Right to Freedom of Religion (Article 25-28) Cultural & Educational Rights (Articles 29-30).
CO4	**classify:** articles Right to Life & Personal Liberty (Article 21) Protection in case of arrest & Detention (Article 22) Right Against Exploitation (Article 23, 24) Right to Freedom of Religion (Article 25-28) Cultural & Educational Rights (Articles 29-30).
CO5	**Compare:** Right to Life & Personal Liberty (Article 21) Protection in case of arrest & Detention (Article 22) Right Against Exploitation (Article 23, 24) Right to Freedom of Religion (Article 25-28) Cultural & Educational Rights (Articles 29-30).

CO-PO Mapping Matrix for Course MDS/2/AEC2/T

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**1**	**-**	**2**	**-**	**-**

CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**2**	**-**	**2**	**-**	**-**
CO 3	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**2.4**	**-**	**2**	**-**	**-**

Course Content
MDS/2/AEC2/T Constitution of India

Unit I	Citizenship (Articles 5-11) Fundamental Rights in General; Definition of State (Article 12); Doctrines of Ultra – Vires, Severability, Eclipse,Waiver (Article 13) Right to Equality (Article 14) Prohibition on Discrimination, Right to Equality of Opportunity (Articles 15,16) Abolition of Untouchability, Titles (Articles 17, 18).
Unit – II	Right to Freedom under Article 19 Freedom of Speech and Expression Freedom of Assembly Freedom of Association Freedom of Movement Freedom of Residence Freedom of Occupation, Trade and Business etc Protection in respect of Conviction under Article 20 Ex post facto Laws Double Jeopardy Self-incrimination.
Unit – III	Right to Life & Personal Liberty (Article 21) Protection in case of arrest & Detention (Article 22) Right Against Exploitation (Article 23, 24) Right to Freedom of Religion (Article 25-28) Cultural & Educational Rights (Articles 29-30).
Unit – IV	Writ jurisdiction of the Supreme Court and High Court, nature and general conditions of Writ jurisdiction(article 32, 226), directive principles of states policy, enforcement of directive principles(article 36-51), fundamental duties(article 51 A), extent of liability of the state(article 299,300), right to

	property(article 300-A).
Text/Reference Books	
Text Books	4. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reilly Media, 2012. 5. SeemaAcharya, Subhasini Chellappan, "Big Data Analytics", Wiley 2015. 3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press.
Reference Books	5. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 6. Jay Liebowitz, "Big Data and Business Analytics" AuerbachPublications, CRC press (2013) 7. AnandRajaraman and Jeffrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012. 8. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley &Sons, 2012.

MDS/2/SEC2/T Cyber Security							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	02	02	Lecture	35	15	3 Hours	TEE/MTE/ Assignment/ Attendance
Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.							
Course Objectives: The objective of this course is to understand the basic concepts of computers, applications of the internet, virtual learning environments and digital editing.							

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:** cyber Security, Cyberspace, Cyber threats, Cyber Attacks, Information Security Architecture, Vulnerability Assessment and Penetration.
CO2	**explain:** the importance and challenges in Cyber Security, Malware threats, Sniffing, Role of forensics Investigator and Forensics Investigation Process.
CO3	**use:** defense Strategies, Vulnerability Assessment and Penetration.
CO4	**classify:** cyber threats, Cyber Attacks, Defense Strategies.
CO5	**apply:** cyber Security mechanisms against Malware threats.

CO-PO Mapping Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Avg	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

Course Content MDS/2/SEC2/T Cyber Security	
Unit – I	**Introduction:** Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security, Organizational Implications.
Unit – II	**Cyber Attacks:** Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.
Unit - III	**Ethical Hacking:** Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration, testing, types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defense Strategies.
Unit – IV	**Introduction to Cyber Forensics:** Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013.
Text/Reference Books	
Text Books	1. Donaldson S., Siegel S., Williams, C.K., Aslam A., "Enterprise Cyber security -How to Build a Successful Cyber Defense Program against Advanced Threats", 1e, Apress, 2015. 2. Nina Godbole, Sumit Belapure, "Cyber Security", Willey, 2011.
Reference Books	1. Roger Grimes, "Hacking the Hacker", 1e, Wiley, 2017. 2. 2. Cyber Law by Bare Act, Govt of India, IT Act 2000.

MDS/2/SEC2/P Cyber Security						
Course Type	Course	Contact	Delivery	Maximum Marks	Exam	Assessment

	Credit	Hours/Week	Mode	External	Internal	Duration	Methods
Compulsory Theory	01	02	Lecture	25	-	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to understand the basic concepts of computers, applications of the internet, virtual learning environments and digital editing.

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CO1	**define:** cyber Security, Cyberspace, Cyber threats, Cyber Attacks, Information Security Architecture, Vulnerability Assessment and Penetration.
CO2	**explain:** the importance and challenges in Cyber Security, Malware threats, Sniffing, Role of forensics Investigator and Forensics Investigation Process.
CO3	**use:** defense Strategies, Vulnerability Assessment and Penetration.
CO4	**classify:** cyber threats, Cyber Attacks, Defense Strategies.
CO5	**apply:** cyber Security mechanisms against Malware threats.

CO-PO Mapping Matrix

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	**1**	**3**	**1**	**1**	**1**	**-**	**3**	**1**	**-**	**2**	**-**	**-**
CO 2	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**2**	**-**	**2**	**-**	**-**
CO	**3**	**1**	**1**	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**

3												
CO 4	**2**	**1**	**1**	**3**	**1**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
CO 5	**2**	**1**	**3**	**1**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**-**
Avg	**2**	**1.4**	**1.4**	**2.2**	**1.8**	**-**	**3**	**2.4**	**-**	**2**	**-**	**-**

Course Content
MDS/2/SEC2/P Cyber Security

Unit – I	**Introduction:** Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security, Organizational Implications.
Unit – II	**Cyber Attacks:** Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.
Unit - III	**Ethical Hacking:** Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration, testing, types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defense Strategies.
Unit – IV	**Introduction to Cyber Forensics:** Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013.

Text/Reference Books

Text Books	3. Donaldson S., Siegel S., Williams, C.K., Aslam A., "Enterprise Cyber security -How to Build a Successful Cyber Defense Program against Advanced Threats", 1e, Apress, 2015. 4. Nina Godbole, Sumit Belapure, "Cyber Security", Willey, 2011.
Reference Books	3. Roger Grimes, "Hacking the Hacker", 1e, Wiley, 2017. 4. 2. Cyber Law by Bare Act, Govt of India, IT Act 2000.