M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH. CSE with Specialization Artificial Intelligence and Data Science)

Scheme effective from 2022-23

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
P	Practical
LC	Laboratory Courses
PCC	Program Compulsory Course.
PEC	Program Elective Course
OE	Open Elective

NOTE: The minor has to be a subject offered by a department other than the department that offers the major of the student or it can be a different major offered by the same department. For example, a student with the declared major in Mechanical Engineering may opt to do a minor in ECE; in which case, the student shall receive the degree B.Tech, Mechanical Engineering with a minor in ECE. A student can do Majors in chosen filed as per the career goal, and a minor may be chosen to enhance the major thus adding the diversity, breadth and enhanced skills in the field.

Advantages of Minor in Engineering:

The minors mentioned above are having lots of advantages and a few are listed below:

- **To apply the inter-disciplinary knowledge gained through a Major (Stream) + Minor.**
- **To enable students to pursue allied academic interest in contemporary areas.**
- **To provide an academic mechanism for fulfilling multidisciplinary demands of industries.**

- **To provide effective yet flexible options for students to achieve basic to intermediate level competence in the Minor area.**
- **Provides an opportunity to students to become entrepreneurs and leaders by taking business/management minor.**
- **Combination in the diverse fields of engineering e.g., CSE (Major) + Electronics (Minor) combination increases placement prospects in chip designing companies.**
- **Provides an opportunity to Applicants to pursue higher studies in an inter-disciplinary field of study.**
- **Provides opportunity to the Applicants to pursue interdisciplinary research.**
- **To increase the overall scope of the undergraduate degrees.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS
B.TECH. CSE with Specialization Artificial Intelligence and Data Science)
w.e.f. 2022-2023

S. No.	Semester	Course Code	Course Title	Teaching Schedule			Internal Assesment	Examination Marks		Total	Credit	Duration of Exam
				L	T	P		Theory	Practical			
1	3rd Sem	PCC-CSE-203G	Data Structure & Algorithm *Common for CSE & AIDS*	3	0	-	25	75	-	100	3	3
2	4th Sem	PCC-CSE-304G	Artificial Intelligence	3	0	0	25	75	-	100	3	3
3	5th Sem	PCC-CSE-305G	Formal Languages & Automata	3	0	-	25	75	-	100	3	3
4.	5th Sem	LC-CSE-213G	Data Structure & Algorithms LAB Using C *Common for CSE & AIDS*	0	0	2	25	-	25	50	1	3
5.	6th Sem	PCC-CSE-207G	Python Programming *Common for CSE & AIDS*	3	0	0	25	75	-	100	3	3
6,	6th Sem	LC-CSE-215G	Python Programming Lab *Common for CSE & AIDS*	0	0	2	25	-	25	50	1	3
7	7th Sem	PCC-CSE-404G	Big Data Analytics *Common for CSE & AIDS*	3	0	0	25	75	-	100	3	3
8	7th Sem	LC-CSE-410G	Big Data Analytics Lab *Common for CSE & AIDS*	0	0	2	25	-	25	50	1	3
		Total								650	18	

Data Structure & Algorithms

Course code	PCC-CSE-203-G				
Category	Professional Core Course				
Course title	Data Structure & Algorithms				
Scheme and Credits	L	T	P	Credits	Semester 3rd
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note:

Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

UNIT-I

I**ntroduction:** Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms , how to design and develop algorithm , Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT-II

Stacks and Queues: Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT-III

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded BinaryTree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT-IV

Sorting and Hashing: Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort, Insertion Sort, Selection Sort Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms And complexity analysis. Minimum Spanning Tree:- Kruskal's Algorithm, Prim's Algorithm.

Suggested books:

1).“Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

2).Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

3).“How to Solve it by Computer”, 2nd Impression by R.G. Dromey, Pearson Education.

Python Programming

Course code	PCC-CSE-207-G				
Category	Professional Core Course				
Course title	Python Programming				
Scheme and Credits	L	T	P	Credits	Semester 3rd
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note:
Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Program Outcome:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.
2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language

UNIT-I

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statementsString manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file

UNIT-II

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, Coursecode PCC-CSE-207G Category Professional Core Course Coursetitle Python Programming Scheme and accessing and replacing values; traversing dictionaries. Hiding

redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

UNIT-III

Simple graphics and image processing: Simple graphics, Turtle operations, Manipulating turtle screen, Drawing two dimensional shapes, examining an object attributes, Taking a random walk, Color and RGB scheme, Image processing: Image manipulation operations, properties of images, image module, copying, blurring and reducing image. Graphical User Interfaces: Terminal based and GUI based programs, Simple GUI-Based Programs, Windows and Window Components, Input and Output with Entry Fields, Defining and Using Instance Variables, Other Useful GUI Resources.

UNIT-IV

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block. Multithreading: Threads and Processes, Sleeping Threads, Producer, Consumer, and Synchronization, The Readers and Writers Problem, Shared Cell Class, Thread-Safe Class.

Reference Books:

1. "Fundamentals of Python: First Programs" Kenneth Lambert, Course Technology, Cengage Learning, 2012
2. "Introduction to Computer Science Using Python: A Computational Problem-Solving Focus",By Charles Dierbach, John Wiley & Sons, December 2012,

Data Structure Lab

Course code	LC-CSE-213-G				
Category	Professional Core Course				
Course title	Data Structure Lab				
Scheme and Credits	L	T	P	Credits	Semester 3rd
	0	0	3	1.5	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

Data Structures Lab List of practical exercises, to be implemented in C Language.

1. Write a menu driven program that implements following operations (using separate functions) on a linear array:
   a) Insert a new element at end as well as at a given position
   b) Delete an element from a given whose value is given or whose position is given
   c) To find the location of a given element
   d) To display the elements of the linear array

2. Write a menu driven program that maintains a linear linked list whose elements are stored in on ascending order and implements the following operations (using separate functions):
   a) Insert a new element
   b) Delete an existing element
   c) Search an element
   d) Display all the elements

3. Write a program to demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.

4. Program to demonstrate the use of stack (implemented using linear linked lists) in evaluating arithmetic expression in postfix notation.

5. Program to demonstration the implementation of various operations on a linear queue represented using a linear array.

6. Program to demonstration the implementation of various operations on a circular queue represented using a linear array.

7. Program to demonstration the implementation of various operations on a queue represented using a linear linked list (linked queue).

8. Program to illustrate the implementation of different operations on a binary search tree.

9. Program to illustrate the traversal of graph using breadth-first search

10. Program to illustrate the traversal of graph using depth-first search.

11. Program to sort an array of integers in ascending order using bubble sort.

12. Program to sort an array of integers in ascending order using selection sort.

13. Program to sort an array of integers in ascending order using insertion sort.

14. Program to sort an array of integers in ascending order using radix sort.

15. Program to sort an array of integers in ascending order using merge sort.

16. Program to sort an array of integers in ascending order using quick sort.

17. Program to sort an array of integers in ascending order using heap sort.

18. Program to sort an array of integers in ascending order using shell sort.

19. Program to demonstrate the use of linear search to search a given element in an array.

20. Program to demonstrate the use of binary search to search a given element in a sorted array in ascending order.

Note: 1. At least Ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or as designed and set by the current institution as per the scope of the syllabus.

Python Programming Lab

Course code	LC-CSE-215-G				
Category	Professional Core Course				
Course title	Python Programming Lab				
Scheme and Credits	L	T	P	Credits	Semester 3rd
	0	0	3	1.5	
Class work	25 Marks				

Exam	25 Marks
Total	50 Marks
Duration of Exam	3 Hours

Course Outcome:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Read and write data from/to files in Python

List of Programs

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Note: 1. At least Ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or as designed and set by the current institution as per the scope of the syllabus.

ARTIFICIAL INTELLIGENCE

Course code	PCC-CSE-304G				
Category	Professional Core Course				
Course title	Artificial Intelligence				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To provide historical perspective of AI and its foundation.
- To provide the most fundamental knowledge to the students so that they become familiar with basic principles of AI towards problem solving, inference, knowledge representation and learning.
- Explore application of AI techniques in Expert systems, Neural Networks.
- Explore the current trends, potential, limitations, and implications of AI.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems. **Problem solving by search**: *Uninformed Search*: Depth First Search (DFS), Breadth First Search (BFS). *Informed Search*: Best First Search, A*. *Local Search*: Hill Climbing. *Problem Reduction Search*: AO*. *Population Based Search*: Ant Colony Optimization, Genetic Algorithm. *Game Playing:* Min Max Algorithm, Alpha-Beta Pruning.

UNIT 2

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames. Knowledge representation issues. Rule based systems.

UNIT 3

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.
Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

UNIT 4

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, Current trends in Artificial Intelligence

Suggested Test books:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010, Pearson Education.

Suggested reference books:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
3. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley 3 Ed.

Course Outcomes:

1. Display the understanding of the historical perspective of AI and its foundation.
2. Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
3. Demonstrate fundamental understanding of various application of AI techniques in Expert systems, Neural Networks.
4. Demonstrate an ability to share in discussion of AI, it’s the current trends, limitations, and implications of AI.

Big Data Analytics

Coursecode	PCC-CSE-404G				
Category	Professional Core Course				
Coursetitle	Big Data Analytics				
Scheme and Credits	L	T	P	Credits	Semester 8
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

1. To Provide an explanation of the architectural components and programming models used for scalable big data analysis.
2. To Identify the frequent data operations required for various types of data and Apply techniques to handle streaming data
3. To describe the connections between data management operations and the big data processing patterns needed to utilize them in large-scale analytical applications
4. To Identify describe and differentiate between relational and non-relational database and how Data Warehouses, Data Marts, Data Lakes, and Data Pipelines work.
5. Explain how the Extract, Transform, and Load process works to make raw data ready for analysis.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all UNITs and remaining eight questions of 15 marks each to be set by taking two questions from each UNIT. The students have to attempt five questions in total, first being compulsory and selecting one from each UNIT.

Course Outcomes

1. For a given query Describe the Big Data landscape including examples of real world big data problems including the three key sources of Big Data: people, organizations, and sensor.
2. For a given specification, Recognize different data elements in your own work and in everyday life problems
3. For a given specification select a data model to suit the characteristics of your data
4. For a given problem one will be able to Retrieve data from example database and big data management systems and identify when a big data problem needs data integration
5. For a given problem one will be able to design an approach to leverage data using the steps in the machine learning process and apply them to explore and prepare data for modelling.

UNIT I

Introduction to Big Data: Big Data: Why and Where, Application and Challenges, Characteristics of Big Data and Dimensions of Scalability, The Six V, Data Science: Getting Value out of Big Data, Steps in the Data science process, Foundations for Big Data Systems and Programming, Distributed file systems

UNIT II

Data Repositories and Big Data Platforms: RDBMS, NoSQL, Data Marts, Data Lakes, ETL, and Data Pipelines, Foundations of Big Data, Big Data Processing Tools, Modern Data Ecosystem, Key Players, Types of Data, Understanding Different Types of File Formats, Sources of Data Using Service Bindings

UNIT III

Introduction to Big Data Modeling and Management:**Data Storage, Data Quality, Data Operations, Data Ingestion, Scalability and Security Traditional DBMS and Big Data Management Systems, Real Life Applications, Data Model: Structure, Operations, Constraints, Types of Big Data Model**

UNIT IV

Big Data Integration and processing: Big Data Processing, Retrieving: Data Query and retrieval, Information Integration, Big Data Processing pipelines, Analytical operations, Aggregation operation, High level Operation, Tools and Systems: Big Data workflow Management

Suggested books:

Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.

Suggested reference books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

5. Bill Franks, “Taming the Big Data Tidal Wave: Finding OpportUNITies in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
7. Pete Warden, “Big Data Glossary”, O’Reily, 2011.
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012
10. Paul Zikopoulos ,DirkDeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Big Data Analytics Lab

Coursecode	LC-CSE-421G				
Category	Big Data Analytics				
Coursetitle	Neural Networks Lab				
Scheme and Credits	L	T	P	Credits	Semester 8
	3	0		3	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To Study of Big Data Analytics and Hadoop Architecture.
2. To Understand Overall Programming architecture of Mapreduce API. Implement MapReduce Programming.
3. To Study HDFS Commands.
4. To Study serializes and deserializes data of integer type in Hadoop.
5. To run a basic Word Count MapReduce program to understand MapReduce Paradigm
6. Basic CRUD operations in MongoDB.
7. Store the basic information about students such as roll no and name using various collection types Map.
8. To run a Grep program on Hadoop to understand Mapreduce Paradigm: To count words in a given file, To view the output file, and To calculate execution time.
9. Installation of SPARK framework with or without Hadoop framework.
10. To Study about the Hive commands using HQL (DDL and DML).

Note: 1. At least Ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or as designed and set by the current institution as per the scope of the syllabus.

FORMAL LANGUAGES AND AUTOMATA

Course code	PCC-CSE-305G				
Category	Professional Core Course				
Course title	Formal Languages & Automata				
Scheme and Credits	L	T	P	Credits	Semester 5
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

- To understand basic concepts of formal languages and automata theory.
- To study the types of Automata i.e. NFA, DFA, NFA with ϵ-transition and their interconversion methods and importance.
- To Study formal languages of different kinds, such as regular and context-free languages. Understand the concept of grammar and its types. Removal of ambiguity and reduced form and Normal forms of grammar.
- To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA &Turing machine.
- To study the various properties of turing machine and their designing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit 1:

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Non-Deterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.

Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit 2:

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit 3:

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions, Normal Form: Chomsky Normal form(CNF) and Greibach Normal Form(GNF),

Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit 4:

Turing machines: The basic model for Turing machines (TM), Deterministic and Non-Deterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested books:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.

Suggested reference books

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
2. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
3. John C. Martin: Introduction to Languages and Automata Theory, 3rd edition, Tata Mcgraw-Hill, 2007

Course Outcomes:

- To use basic concepts of formal languages of finite automata techniques.
- To Design Finite Automata's for different Regular Expressions and Languages.

- To Construct context free grammar for various languages.
- To solve various problems of applying normal form techniques, push down automata and Turing Machines.

1. B.TECH. CSE with Specialization Artificial Intelligence and Data Science)
2. B.TECH. CSE with Specialization in Artificial Intelligence and Machine Learning
3. B.Tech. CSE with Specialization Cyber Security