

Basaveshwar Engineering College, Bagalkote
Department of Artificial Intelligence and Machine Learning Engineering
Scheme of Teaching and Evaluation
(Academic Year 2021 – 2022 Admitted NEP)

III Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CRE DITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1.	21UMA301C	Numerical Techniques and Integral Transforms	03	03	-	-	50	50	100
2.	21UAI312C	Data Structures and Applications	03	03	-	-	50	50	100
3.	21UAI316C	Computer Organization	03	03	-	-	50	50	100
4.	21UAI304C	AI and its Applications	03	03	-	-	50	50	100
5.	21UAI305C	Problem Solving with Python	03	03	-	-	50	50	100
6.	21UAI313L	Data Structures Lab	01	-	-	02	50	50	100
7.	21UAI314L	Python Programming Lab	01			02	50	50	100
8.	21UAI315L	Working with Office	01	01	-	-	50	50	100
9.	21UHS324C	Universal Human Values – II	01	01	-	-	50	50	100
10.	21UHS321C	Constitution of India	01	01	-	-	50	50	100
Total			20	18	00	04	500	500	1000

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IV Semester BE

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	BSC	21UMA401C	Statistics and Probability Distribution	03	03	-	-	50	50	100
2.	PCC	21UAI402C	Analysis & Design of Algorithms (I)	04	03	-	02	50	50	100
3.	PCC	21UAI403C	Operating Systems	03	03	-	-	50	50	100
4.	PCC	21UAI404C	Introduction to Data Science	03	03	-	-	50	50	100
5.	PCC	21UAI417C	Embedded Systems (I)	03	02	-	02	50	50	100
6.	PCC	21UAI416L	Data Science Lab	01	-	-	02	50	50	100
7.	INT	21UAI409I	Internship	02	-	-	-	50	50	100
8.	HSSM	21UHS422C 21UHS423C	Sanskrutika Kannada **/Balake Kannada***	01	01	-	-	50	50	100
9.		21UMA401M	Bridge Course Mathematics – II *	00	03	-	-	50	50	100
Total				20	18	-	06	450	450	900

*For lateral entry (Diploma) students only

**Students who have studied Kannada at primary level

*** Students who have not studied Kannada at primary level

21UAI312C	Data Structures and Applications	Credits: 03
L:T:P:3:0:0		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT - I	10 Hrs
<p>The stack: Definition and Examples: Primitive operations, An Example, The stack as an Abstract data type. Representing Stacks in C: Implementing pop operation, Testing for exceptional conditions, Implementing the push operations. , An Example- Infix, Postfix and Prefix: Basic Definitions and Examples, Evaluating a postfix expression, Program to evaluate a postfix expression, Limitations of the program, Converting an expression from Infix to Postfix, Program to convert an expression from Infix to Postfix.</p>	
UNIT – II	10 Hrs
<p>Recursion: Recursive definition and processes: The factorial function, Properties of recursive definitions or Algorithms. , Recursion in C: Factorial in C., writing recursive programs: The Towers of Hanoi Problem.</p> <p>Queues: The queue and its sequential representation: The queue as an abstract data type, C implementation of queues, The insert operation, The priority queue, Array implementation of a priority queue.</p> <p>Lists: Linked lists: Inserting and removing nodes from a list, Linked implementation of stacks, The getnode and freenode operations, Linked implementation of queues, The linked list as a data structure, Examples of list operations, List implementation of priority queues, Header Nodes.</p>	
UNIT - III	10 Hrs
<p>Lists in C: Array implementation of lists, Limitations of the array implementation, Allocating and freeing dynamic variables, Linked lists using dynamic variables, Queues as lists in C, Examples of list operations in C, Non integer and non homogeneous lists, Comparing the dynamic and array implementation of lists, Implementing Header Nodes. An example: simulation using linked lists.</p> <p>Other list structures: Circular lists, The stack as a circular list, The queue as a circular list, Primitive operations on circular lists, The Josephus problem, Header nodes, Addition of long positive integers using circular lists.</p>	
UNIT - IV	10 Hrs
<p>Trees: Binary trees: Basics, Operation on Binary trees, Applications of Binary trees. Binary tree representations: Node representations of Binary trees, Node Representation of binary trees, Internal & external nodes, Implicit array representation of Binary trees, Choosing a Binary tree representation, Binary tree traversal in C, traversal using a father field, heterogeneous binary trees. Trees and their applications: C representation of trees, Tree traversals, General expressions as trees, Evaluating an expression tree, Constructing tree.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Data structure using C”, Aaron M. Tennenbaum, Yedidyah Langsam and Moshe J. Augenstein, Pearson Education/PHI 2006. 2. 	

Reference books:

1. Behrouz A. Forouzan and Richard F. Gilberg, Thomson, “Computer Science A structured Programming Approach using C”, II edition, 2003.
2. Richard F. Gilberg and Behrouz, “Data structures A pseudo code approach with c “, Thomson, 2005.
3. Robert Kruse and Breuse Leung, ”Data structures and program Design in C”, PEARSON Education, 2007.
4. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
5. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
6. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

Course Outcomes:

CO 1. Identify different data structures and their applications

CO 2. Apply stack and queues in solving problems.

CO 3. Demonstrate applications of linked list.

CO 4. Explore the applications of trees to model and solve the real-world problem.

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	2	2										1		
CO2		3	3	2	1								1		
CO3		3	3	2	1								1		
CO4		3	3	2	1								1		

21UAI316C	Computer Organization	Credits:03
L:T:P:3:0:0		CIE Marks:50
Hours/Week:40/03		SEE Marks:50

UNIT - I	10 Hrs
<p>Simplification of Boolean Expressions: K-maps and The Quine-McCluskey method. Logic Design with MSI Components, Flip- Flops, Counters: Binary adders and subtractors, Decimal adders, Comparators, Decoders, Multiplexers. The basic Bi-stable element, Latches, Master-Slave flip-flops (Pulse-Triggered flip-flops), Edge triggered flipflops, Characteristic equations, Registers, Counters, Design of synchronous counters.</p>	
UNIT – II	10 Hrs
<p>Basic structure of Computers: Computer types, Functional Units, Basic operational concepts, Bus structures. Machine instructions and programs: Numbers, Arithmetic operations and characters, Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes.</p>	
UNIT - III	10 Hrs
<p>Input/output organization: Accessing I/O devices, Interrupts - Interrupt hardware, Enabling and Disabling interrupts, Handling multiple devices, Controlling device requests, Exceptions, Direct memory access - Bus arbitrations, Buses - Asynchronous bus and Synchronous bus, Interface circuits - Parallel port and serial port, Standard I/O Interfaces - Peripheral component interconnect Bus, SCSI bus, USB.</p> <p>The memory system: Some basic concepts, Semiconductor RAM memories - Internal organization of memory chips, Static memories, Synchronous DRAMs, Synchronous DRAMs, Read only memories, speed, size, and cost, cache memories.</p>	
UNIT - IV	10 Hrs
<p>Arithmetic Unit: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer Division.</p> <p>Basic Processing Unit: Some fundamental concepts, Execution of complete instruction, Hardwired control, Micro programmed control, Micro instructions.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Donald D. Givone, Digital Principles and Design, McGraw Hill Edition 2002 2. Hamacher, Zvonko Vranesic, Safwat Zaky, 2002, “Computer Organization”, Fifth Edition, MGH. 	
<p>Reference books:</p> <ol style="list-style-type: none"> 1. J. P. Hayes,1998, “Computer Architecture and Organization”, 3th Edition, MGH. 2. William Stallings, 2007, “Computer Organization and Architecture”, 7th Edition, PHI. 	
<p>Course Outcomes:</p> <p>CO1: Understand the basic concepts of Boolean algebra and digital logic design.</p> <p>CO2: Explain the functional units, addressing modes, instruction formats and assembly programming.</p> <p>CO3: Demonstrate the organization of various I/O devices and system memory hierarchy.</p> <p>CO4: Design of arithmetic and basic processing units</p>	

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	3	1	3	2			1						1		
CO2	3	2	3	1			2								
CO3	3	1	3	1			1						1		
CO4	3	2	3	3			1						1		

21UAI304C	AI and Its Applications L:T:P:3:0:0	03-Credits
Hrs/Week:03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs
<p>Introducing AI: Defining the Term AI, Discerning intelligence, Discovering four ways to define AI, Understanding the History of AI, Starting with symbolic logic at Dartmouth, Continuing with expert systems, Overcoming the AI winters, Considering AI Uses, Avoiding AI Hype, Connecting AI to the Underlying Computer.</p> <p>Defining the Role of Data: Finding Data Ubiquitous in This Age, Understanding Moore's implications, Using data everywhere, Putting algorithms into action.</p> <p>Considering the Use of Algorithms: Understanding the Role of Algorithms, Understanding what <i>algorithm</i> means, Starting from planning and branching, Playing adversarial games, Using local search and heuristics, Discovering the Learning Machine, Leveraging expert systems, Introducing machine learning, Touching new heights.</p> <p>Pioneering Specialized Hardware: Relying on Standard Hardware, Understanding the standard hardware, Describing standard hardware deficiencies, Using GPUs, Considering the Von Neumann bottleneck, Defining the GPU, Considering why GPUs work well, Creating a Specialized Processing Environment, Increasing Hardware Capabilities, Adding Specialized Sensors, Devising Methods to Interact with the Environment.</p>	
UNIT - II	10 Hrs
<p>Seeing AI Uses in Computer Applications: Introducing Common Application Types, Using AI in typical applications , Realizing AI's wide range of fields, Considering the Chinese Room argument, Seeing How AI Makes Applications Friendlier, Performing Corrections Automatically, Considering the kinds of corrections, Seeing the benefits of automatic corrections, Understanding why automated corrections don't work, Making Suggestions, Getting suggestions based on past actions, Getting suggestions based on groups, Obtaining the wrong suggestions, Considering AI-based Errors.</p> <p>Using AI to Address Medical Needs: Implementing Portable Patient Monitoring, Wearing helpful monitors , Relying on critical wearable monitors, Using movable monitors, Making Humans More Capable, Using games for therapy , Considering the use of exoskeletons, Addressing Special Needs , Considering the software-based solutions , Relying on hardware augmentation, Seeing AI in prosthetics , Completing Analysis in New Ways, Devising New Surgical Techniques, Making surgical suggestions , Assisting a surgeon, Replacing the surgeon with monitoring, Performing Tasks Using Automation, Working with medical records, Predicting the future, Making procedures safer, Creating better medications, Combining Robots and Medical Professionals.</p> <p>Relying on AI to Improve Human Interaction: Developing New Ways to Communicate, Creating new alphabets, Automating language translation, Incorporating body language, Exchanging Ideas, Creating connections, Augmenting communication, Defining trends , Using Multimedia , Embellishing Human Sensory Perception, Shifting data spectrum, Augmenting human senses</p>	

UNIT - III	10 Hrs
<p>Performing Data Analysis for AI: Defining Data Analysis, Understanding why analysis is important, Reconsidering the value of data, Defining Machine Learning, Understanding how machine learning works. Understanding the benefits of machine learning, Being useful; being mundane, Specifying the limits of machine learning, Considering How to Learn from Data, Supervised learning, Unsupervised learning, Reinforcement learning.</p> <p>Employing Machine Learning in AI: Taking Many Different Roads to Learning, Discovering five main approaches to AI learning, Delving into the three most promising AI learning, approaches, Awaiting the next breakthrough, Exploring the Truth in Probabilities, Determining what probabilities can do, Considering prior knowledge, Envisioning the world as a graph, Growing Trees that Can Classify, Predicting outcomes by splitting data, Making decisions based on trees, Pruning overgrown trees.</p> <p>Developing Robots and flying with drones: Defining Robot Roles, Overcoming the sci-fi view of robots , Knowing why it’s hard to be a humanoid, Working with robots, Assembling a Basic Robot , Considering the components, Sensing the world , Controlling a robot, Acknowledging the State of the Art, Flying un manned to missions, Meeting the quadcopter, Defining Uses for Drones, Seeing drones in non military roles, Powering up drones using AI, Understanding regulatory issues.</p>	
UNIT - IV	10 Hrs
<p>Understanding the Non starter Application: Using AI Where It Won’t Work, Defining the limits of AI, Applying AI incorrectly, Entering a world of unrealistic expectations, Considering the Effects of AI Winters, Understanding the AI winter, Defining the causes of the AI winter, Rebuilding expectations with new goals, Creating Solutions in Search of a Problem, Defining a gizmo, Avoiding the infomercial, Understanding when humans do it better, Looking for the simple solution.</p> <p>Seeing AI in Space: Observing the Universe, Seeing clearly for the first time, Finding new places to go, Considering the evolution of the universe, Creating new scientific principles, Performing Space Mining, Harvesting water, Obtaining rare earths and other metals, Finding new elements, Enhancing communication, Exploring New Places, Starting with the probe, Relying on robotic missions, Adding the human element, Building Structures in Space , Taking your first space vacation, Performing scientific investigation, Industrializing space, Using space for storage.</p> <p>Adding New Human Occupations: Living and Working in Space, Creating Cities in Hostile Environments, Building cities in the ocean, Creating space-based habitats , Constructing moon-based resources, Making Humans More Efficient, Fixing Problems on a Planetary Scale, Contemplating how the world works, Locating potential sources of problems, Defining potential solutions, Seeing the effects of the solutions, Trying again.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. “Artificial Intelligence for Dummies” by John Paul Mueller and Luca Massaron, Published by: John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774, www.wiley.com, Copyright © 2018 by John Wiley & Sons, Inc., Hoboken, New Jersey, Published simultaneously in Canada. 	

Reference books:

1. “Artificial Intelligence for all”, Utpal Chakraborty, BPB Publications, Feb2020
2. “Artificial Intelligence”, Dr. Praphat Kumar, BPB Publications, Jan2019
3. “The Quest for Artificial Intelligence:A History of Idea and Achievements”, Nils J.Nilsson, Stanford University , Cambridge University Press,2010.
4. “Artificial Intelligence: How 50 Successful Companies used Artificial Intelligence to solve problems, Bernard Marr, Wiley Publications,2019.

Course Outcomes:

CO 1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations

CO2. Demonstrate proficiency in usage of hardware and software platforms for AI based applications

CO 3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques

CO 4. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	1	1										1	3	
CO2	1	3	3		3								1	3	3
CO3	1	2	2										1	3	1
CO4	1	1	1			1		1					1	3	2

21UAI305C	Problem Solving with Python	Credits:03
L:T:P:3:0:0		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT - I	10 Hrs
<p>Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements</p>	
UNIT - II	10 Hrs
<p>The List Data Type: Getting Individual Values in a List with Indexes, Negative Indexes, Getting Sublists with Slices, Getting a List's Length with len(), Changing Values in a List with Indexes, List Concatenation and List Replication, Removing Values from Lists with del Statements. Working with Lists: Using for Loops with Lists, The in and not in Operators. Operations on tuples: indexing, slicing, concatenation, repeating. Functions on tuple: len(), count(), index(), sorted(), min(), max(), and sum(). Functions on set: add(), clear(), copy(), difference(), difference_update(), discard(), intersection(), intersection_update(), isdisjoint(), issubset(), issuperset(), pop(), remove(), update(), union(). The Dictionary Data Type: Dictionaries vs. Lists, The keys(), values(), and items() Methods, Checking Whether a Key or Value Exists in a Dictionary, The get() Method, The setdefault() Method.</p>	
UNIT - III	10 Hrs
<p>Operations on string. Useful String Methods: The upper(), lower(), isupper(), and islower() Methods , The isX() Methods ,The startswith() and endswith() Methods, The join() and split() Methods, Splitting Strings with the partition() Method, Justifying Text with the rjust(), ljust(), and center() Methods, Removing Whitespace with the strip(),rstrip(), and lstrip() Methods. Oops concepts: Object, Class, Method, Inheritance, Polymorphism, Data abstraction Encapsulation. Exception Handling.</p>	
UNIT - IV	10 Hrs
<p>Reading and Writing Files: Files and File Paths , Backslash on Windows and Forward Slash on macOS and Linux, Using the / Operator to Join Paths, ,The Current Working Directory, The Home Directory, Absolute vs. Relative Paths, Creating New Folders Using the os.makedirs() Function, Handling Absolute and Relative Paths, Getting the Parts of a File Path, Finding File Sizes and Folder Contents, Modifying a List of Files Using Glob Patterns, Checking Path Validity, The File Reading/Writing Process, Opening Files with the open() Function, Reading the Contents of Files, Writing to Files. Working with CSV Files: The csv Module, reader Objects, Reading Data from reader Objects in a for Loop, writer Objects, The delimiter and lineterminator Keyword Arguments, DictReader and DictWriter CSV Objects.</p>	

Text Books:

1. Al Sweigart, “Automate the Boring Stuff with Python”, 2 nd Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at <https://automatetheboringstuff.com/>) (Chapters 1 to 18)
2. Core Python Programming, R. Nageswara Rao, 2018, Dreamtech press

Reference books:

1. Programming with python, T R Padmanabhan, 2017, Springer.
2. Python for Data Analysis, Wes McKinney, 2012, O.Reilly.

e-Resources and other Digital Material:

1. <http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>
2. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
3. <https://www.w3schools.com/python/>
4. Python Tutorial (tutorialspoint.com)

Course Outcomes:

1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples, sets, dictionaries and strings.
3. Implement the object oriented programming concepts in python
4. Demonstrate the use of built-in functions to navigate the file system.
5. Implement basic operations on PDF, JSON and other file formats

21UA313L	Data Structures Lab	Credits:01
L:T:P:0:0:2		CIE Marks:50
Total Hours/Week:40/03		SEE Marks:50

S. No.	Assignment
1.	Program on implementation of Stack using ADT
2.	Program on applications of stack using ADT
3.	Program on recursion
4.	Program on implementation of different types queues using ADT
5.	Program on developing stack and queue using linked list using ADT
6.	Program on implementing different operations on linked list using ADT
7.	Program on applications of linked lists using ADT
8.	Program on creation of BT and BST using ADT

Course Outcomes:

1. Design generic and reusable C code to implement ADT's for linear data structures like stack, queue, linked list and non linear data structures BT and BST and use the same to solve real time applications.
2. Compile, debug and execute the above C codes and analyze the output for different test cases.

21UAI314L	Python Programming Lab	Credits01
L:T:P:0:0:2		CIE Marks:50
Total Hours/Week:40/03		SEE Marks:50

Sl. No.	Assignment
1.	Implementation of Python fundamentals, data types, operators, flow control and exception handling in Python
2.	Demonstrating creation of functions, passing parameters and return values
3.	Demonstration of manipulation of strings using string methods
4.	Discuss different collections like list, tuple and dictionary
5.	Demonstration of pattern recognition with and without using regular expressions
6.	Demonstration of reading, writing and organizing files.
7.	Demonstration of the concepts of classes, methods, objects and inheritance
8.	Demonstration of classes and methods with polymorphism and overriding
9.	Demonstration of working with excel spreadsheets.
10.	Demonstration of working with PDF, word and JSON files

Course Outcomes:

CO 1. Demonstrate proficiency in handling of loops and creation of functions.

CO 2. Identify the methods to create and manipulate lists, tuples and dictionaries.

CO 3. Discover the commonly used operations involving regular expressions and file system.

CO 4. Interpret the concepts of Object-Oriented Programming as used in Python.

CO 5. Determine the need for scraping websites and working with PDF, JSON and other file formats.

21UAI315L	Working with Office	Credits:01
L:T:P:1:0:0		CIE Marks:50
Total Hours/Week:40/03		SEE Marks:50

List of Laboratory Assignments

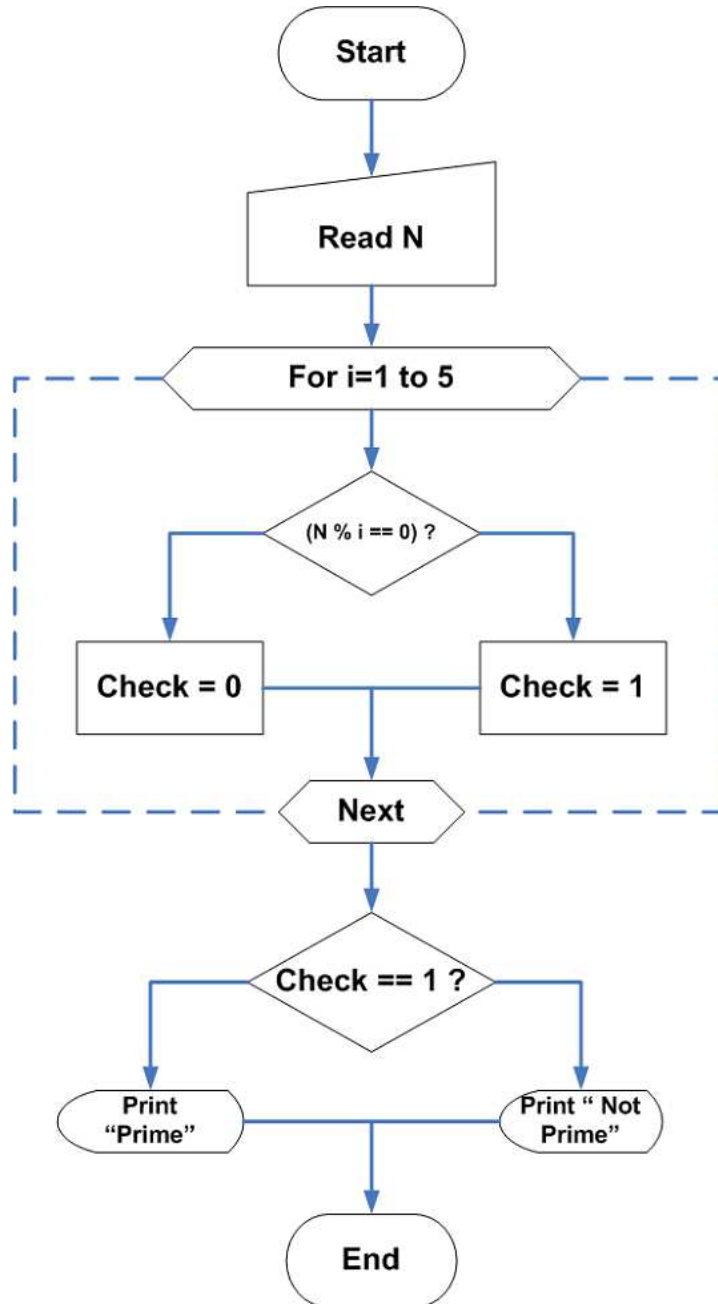
Sl.No	Assignment
1	<p>Prepare an MS word document with the following specifications.</p> <p style="text-align: center;">MS-WORD</p> <p>Microsoft Word is a word processor developed by Microsoft. It was first released in 1983 under the name Multi-Tool Word for Xenix systems. MS Word is a popular word-processing program used primarily for creating documents such as letters, brochures, learning activities, tests, quizzes and students' homework assignments. There are many simple but useful features available in Microsoft Word to make it easier for study and work. That's why so many people would prefer to convert the read-only PDF to editable Word and edit PDF in Word.</p> <ol style="list-style-type: none"> i Type the paragraph above as it is using “Calibri font”, font size 12. ii Use margins as, top:1.5, bottom:2, left:2, right:1 inches, set paper size:A4. iii Use heading “MS-WORD”, font size: 16, font color: Magenta, font face: Arial Black. Underline the “MS-WORD” using underline option. iv With first letter “dropped” (use drop cap option) set paragraph spacing 1.5. Insert a text box and move the whole paragraph into the text box. Align paragraph content justify. Apply background color. v Insert an image beside the paragraph side-by-side. vi Use three columns from the second paragraph onwards till the 2/3rd of the page. Add contents related to MS word with relevant headings. vii In the remaining part of the document, create a table using table menu with, <ol style="list-style-type: none"> a) At least 4 columns and 6 rows. b) Perform cell merging in row and columns. c) Use proper table border and color. d) Insert proper content into the table with proper text formatting. viii Make the word “MS-WORD” as the watermark of the document ix View your document in portrait and landscape view using orientation option in page layout menu. x Insert page number at the bottom of the page using page number option. xi Insert header & footer using the header and footer option. xii Insert file location in the footer. xiii Change the border of the page using page border option. xiv Inserting a Document's File Location xv Add hyperlink to access other documents
2	<p>Prepare an MS Word document to demonstrate inserting mathematical equations such as follows.</p> <p style="text-align: center;">PART-A ENGINEERING MATHEMATICS</p>

1	With usual notation, prove that for the curve $r = f(\theta)$, $\frac{1}{p^2} =$
2	Using Maclaurin's series, prove that $\sqrt{1 + \sin 2x} = 1 + x - \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!}$
3	Evaluate: i) $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{1/x}$ ii) $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x}{2} \right)^{1/x}$
4	Evaluate $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2 + y^2 + z^2) dz dy dx$
5	Show that $\beta(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$
6	Prove that $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \cdot \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} = \pi$
7	Find the rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ by applying elementary
8	If $u = \operatorname{cosec}^{-1} \left(\frac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}} \right)$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = -\frac{1}{6} \tan u$
9	Prove that $\operatorname{div}(\phi \vec{A}) = \phi (\operatorname{div} \vec{A}) + \operatorname{grad} \phi \cdot \vec{A}$.

Express $f(t) = \begin{cases} \sin t, & 0 < t \leq \frac{\pi}{2} \\ \cos t, & \frac{\pi}{2} < t \leq \pi \\ 1, & \pi < t \end{cases}$ in terms of unit step functions and hence find its Laplace transform.

PART-B

Draw the flow chart to check the given number is prime or not.



3 a) Prepare an invitation letter to invite employees of other companies to attend the

workshop. Use mail.
merge option of MS word to select the names and other information of HR managers.
b) Prepare a macro to create letter template of the problem defined in (a).

- 4** Prepare an excel sheet to compute the correlation coefficient ‘**r**’ between two variables for the following dataset. Also compare the results with the builtin function =**CORREL()** and =**PEARSON()** available in MS Excel. Also draw the line chart **Number of Hours versus CGPA** demonstrating the correlation.

- 5** Prepare a payroll for the following list of faculty using MS Excel.

1.1 List of Faculty

Sl. No	Faculty Name	Designation
1	Ram Mohan Reddy	Professor
2	Anand Kumar M	Professor
3	Pijush M	Professor
4	Bhavana Kiran	Associate Professor
5	Dinesh Naik	Associate Professor
6	Soumaya Kamath S	Associate Professor
7	H S Nagendra Swami	Assistant Professor
8	Hamsaveni B N	Assistant Professor
9	Vijaykumar S	Assistant Professor
10	Praveenkumar C	Assistant Professor

1.2 Basic salary rate details

- The slab on the excel payroll calculation will contain the employee’s salary details.
- First column includes cell of Pay days in that month.
- Second column must have the Basic Salary details of the employee.
- (Assistant Professor:** Rs. 57700-68900 with AGP of Rs.6000 or Rs. 7000,
- Associate Professor:** Rs.79800-144200, with AGP of Rs.9000,
- Professor:** Rs. 144200 -182200, with AGP of Rs.10000)
- Calculate Dearness Allowance (DA) with 38%.
- Calculate House Rent Allowance (HRA) 16%.
- Total Salary calculation.
- Gross earned salary details
- Deduction details
- Net salary details

- 6** Perform Data analysis with pivot table for the following case study.
Case Scenario: Headquartered in Memphis, TN, Grenadier Super Store (GSS) specializes in office supplies and furniture. The company's customers range from

individual consumers and small businesses (retail), to corporate organizations (wholesale) located in the United States and Canada.

Project Requirements:

1. Use the data file (Excel Format) **sales_data.xlsx** given to you.

a. Using data from the starting data file, please create PivotTables and PivotCharts that can be used to answer the following questions.

b. What are the Regional Sales by Product Category and Product Sub-Category?

Please create ONE PivotTable showing Total Sales breakdown by Region, Product Category, and Product Sub-Category. Use information from the PivotTable to answer the following questions:

- i. What was the Total Sales figure included in this data set?
- ii. Which Product Category had the highest sales?
- iii. Which Region had the lowest sales?
- iv. What was the Total Sales of Appliances in Ontario?

c. Who are the most valuable customers?

Please create ONE PivotTable showing the Customer Names who placed orders with GSS during 1-6-2014 to 30-6-2015. For each customer, please also show the total number of orders, Total Sales, and Total Profit. Add a Slicer or a Filter that can be used to show the information specifically for each Customer Segment. Use information from the PivotTable to answer the following questions (Hint: Filter and sort the data in the PivotTable to locate the answer):

- i. Which Small Business customer had the highest sales?
- ii. Which Corporate customer placed the most number of orders in 2015-2016? How many orders were placed by the Corporate customer?
- iii. Which Consumer customer was the most profitable one?
- iv. What is the sales figure of the least profitable Home Office customer?

7 Creating and Querying Databases using MSAccess.

This lab requires the following Access techniques:

- 1. Creating a new databases, tables, and relationships
- 2. Add data to tables
- 3. Build simple queries using Query Builder

8 Prepare an MS Access file to create and query the database using forms.

Inthis exercise,youwill create a databasethat includes a table,form,report, andqueries.

Assignment Instructions:

- 1. Create a New blank database
- 2. Name the Access file as your last name in all lowercase letters. (For example, can would save your file as “learner.accdb”)
- 3. In Design View, create a table using the structure shown below:
 - 1. Name the table: Student List
 - xv.2 Set the “USN” field as the Primary Key
 - xv.3 AdmQuota= K for KEA, C for ComedK, M for Management

FieldName	DataType	FieldSize	Otherfieldproperty
USN (PrimaryKey)	ShortText	10	
First Name	ShortText	Default	

Last Name	ShortText	Default		
Branch	ShortText	Default		
Year	Date/Time	Default		
Address	ShortText	Default		
City	ShortText	Default		
State	ShortText	Default		
ZipCode	ShortText	6		
AdmQuota	ShortText	1		
FeesBalance	Currency	Default		

1. In Datasheet View, add the data below to the “StudentList” table.
2. Create a form using the Form Wizard based on the “StudentList” table
 - Use All Fields
 - Layout: Columnar
 - Form Name: StudentForm
6. In Design View, change the Theme to “Executive”
 7. Add the following records using the Form:
8. When you have finished adding the records, save the form as “StudentForm”
9. Using the Report Wizard, create a report based on the “StudentList” table, according to the following specifications:
 - a. Use All Fields
 - b. Group by: First Term Attended
 - c. Layout: Stepped
 - d. Orientation: Landscape
 - e. Title the report: Student Report
 - f. Adjust column widths in Design View as necessary
10. Create Queries

Query 1: Create a query from the “StudentList” table using the Simple Query Wizard. The query is as follows:

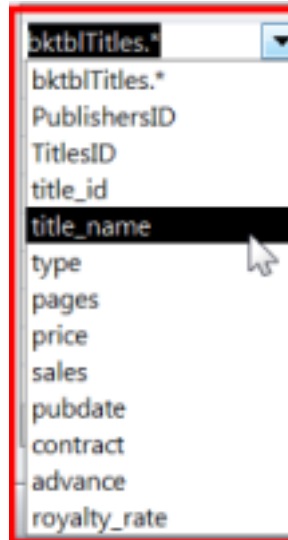
 - i. Generate a report with the USN and names of the students who taken admission under KEA
 - ii. Select the appropriate fields and the appropriate criteria. Run this query.

Query 2: Create a query from the “StudentList” table using the Simple Query Wizard. The query is as follows:

 - i. Generate a report with the USN and names of the students whose FeeBalance is more than 50,000 Rs.
 - ii. Select the appropriate fields and the appropriate criteria. Run this query.

- 9 Prepare an MS Access file to create and query the database using advanced queries. Create database with following tables:
- 1) bktblPublishers
 - 2) bktblAuthors
 - 3) bktblTitles

bktblPublishers attributes



Answer the following queries:

Exercise 3

Create a new query that shows all the information in the bktblAuthors and bktblTitles tables.

Exercise 4

Create a new query that displays title ID, title name, the publisher's name, and the author's first and last names.

Exercise 5

Modify the query that you created in Exercise 4 so that it only shows records corresponding to Abatis Publishers. Only show Abatis Publishers records with royalty rates less than 0.08 or with advances that are less than 30000. Do not show the advance and royalty rates fields in the query.

Exercise 1

The expression we created for profit is too simplified. Modify it so that the profit is calculated as $((\text{sales} * \text{price}) - \text{advance}) * (1 - \text{royalty rate})$.

Exercise 2

In Query 3, remove the au_fname and au_lname fields from the query. Create a new field called Name that combines both names (with a space between them). Use the & operator.

10	<ol style="list-style-type: none"><li data-bbox="321 149 1414 222">1. Prepare the MS Powerpoint slides (Minimum 6 slides) which demonstrates use of hyperlinks, Inserting images, clip art, audio video, Tables and charts.<li data-bbox="321 222 1414 296">2. Create master layouts (slide, template and notes), inserting: background, textures, design templates, Hidden slides.<li data-bbox="321 296 1414 333">3. Use auto content wizard, slide transition, custom animation, rehearsing.
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21UAI402C	Analysis & Design of Algorithms (I)	Credits:04
L:T:P:3:0:2		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT-I	10 + 6 Hrs
<p>Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures.</p> <p>Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, Example – Fibonacci Numbers.</p> <p>Brute Force: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.</p>	
UNIT-II	10 + 6 Hrs
<p>Divide and Conquer: Mergesort, Quicksort, Binary Search, Binary Tree Traversals and Related Properties, Multiplication of Large Integers and Strassen’s Matrix Multiplication.</p> <p>Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.</p>	
UNIT-III	10 + 6 Hrs
<p>Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction.</p> <p>Space and Time Tradeoffs: Sorting by Counting, Input Enhancement in String Matching, Hashing, B-Trees.</p> <p>Dynamic Programming: Computing a Binomial Coefficient, Warshall’s and Floyd’s Algorithms, Optimal Binary Search Trees. The Knapsack Problem and Memory Functions.</p>	
UNIT-IV	10 + 6 Hrs
<p>Greedy Technique: Prim’s Algorithm, Kruskal’s Algorithm, Dijkstra’s Algorithm, Huffman Trees.</p> <p>Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, Problems Coping with the Limitations of Algorithm Power: Backtracking, Branch-and-Bound.</p>	
Reference Books	
<p>Reference books:</p> <ol style="list-style-type: none"> 1. “Introduction to Algorithms”, Stein, PHI, 2nd Edition, 2. “Computer Algorithms”, Horowitz E., Sahni S., Rajasekaran S., Galgotia Publications, 2001 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. “Introduction to The Design & Analysis of Algorithms”, Anany Levitin, Pearson Education, 3rd Edition, 2017 	
Course Outcomes	
<p>After completion of the course student will be able to</p> <ol style="list-style-type: none"> 1) Understand the notion of an algorithm, asymptotic notations and different problem types. 2) Analyze the recursive and non-recursive algorithms. 3) Understand the algorithm design techniques using divide and conquer approach. 4) Understand the algorithm design techniques using dynamic programming and greedy approaches. 5) Explain the algorithm design techniques using backtracking, branch & bound, NP-complete and NP-hard problems. 	

ANALYSIS AND DESIGN OF ALGORITHMS LAB ASSIGNMENTS

- 1) a) Write a C program to search a given element using binary search method and determine its time complexity.

b) Write a C program to sort a given set of numbers using the quick sort method and determine its time complexity.
- 2) Write a C program to sort a given set of numbers using the merge sort method and determine its time complexity.
- 3) Write a C program to check whether a given graph is connected or not using DFS method and determine its time complexity.
- 4) Write a C program to print all the nodes reachable from a given starting node in a di-graph using BFS method and determine its time complexity.
- 5) Write a C program to sort a given set of numbers using the heap sort method and determine its time complexity.
- 6) a) Write a C program to find the Transitive Closure of a graph using Warshall's algorithm.

b) Write a C program to find all pair shortest path of a graph using Floyd's algorithm.
- 7) Write a C program to implement 0/1 Knapsack problem using Dynamic Programming and determine its time complexity.
- 8) Write a C program to find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm and determine its time complexity.
- 9) Write a C program to find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and determine its time complexity.
- 10) Write a C program to find the shortest path from a given vertex to other vertices in a weighted connected graph using Dijkstra's algorithm and determine its time complexity

21UAI403C	Operating Systems	Credits:03
L:T:P:3:0:2		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT-I	10 Hrs
<p>Introduction to operating systems, types and services. Role of Operating systems: user view, system view; Operating System structure; Operating System operations; Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines. Process management: Process concept; Concepts of process: Process status, Process description, Process model, Operations on processes.</p>	
UNIT-II	10 Hrs
<p>Process management, threads and process synchronization. Process Scheduling: Basic concepts; scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling, Inter-process communication (Intd.), Threads: concepts, Multi-Threaded Programming: Overview; Multithreading models; Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.</p>	
UNIT-III	10 Hrs
<p>Deadlocks and memory management: Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.</p>	
UNIT-IV	10 Hrs
<p>Virtual Memory Management: Background; Demand paging; Page replacement; Allocation of frames.File system: concepts and implementation, secondary storage structures. File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.</p>	
Reference Books	
1) D.M Dhamdhare: Operating systems - A concept based Approach, 2 nd Edition, Tata McGraw- Hill, 2002.	
Text Books:	
1) Abraham Silberschatz, Peter Baer Galvin , Greg Gagne: Operating System 7 th edition, Addison Wesley	
Course Outcomes	
<p>After completion of the course student will be able to</p> <ol style="list-style-type: none"> 1. Explain the core structure and different services provided by Operating System at different levels 2. Apply the concepts of process scheduling algorithms and synchronization techniques in solving real time problems 3. Exhibit the knowledge of memory management techniques 4. Exhibit the knowledge of secondary storage management techniques and security solutions 	

21UAI404C	Introduction to Data Science	Credits:03
L:T:P:3:0:0		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT-I	10 Hrs
<p>Introduction: Data Science. Applications of data science. Data science related to other field. Relationship between data science and Information science. Computational thinking. Skills for data science. Tools for data science. Issues of Ethics, Bias, and Privacy in Data Science.</p> <p>Data: Introduction, Data types: Structured Data, Unstructured Data, Challenges with Unstructured Data. Data Collections: Open Data, Social Media Data, Multimodal Data, Data Storage and Presentation.</p> <p>Data Pre-processing: Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization.</p>	
UNIT-II	10 Hrs
<p>Techniques: Introduction, Data Analysis and Data Analytics, Descriptive Analysis: Variables, frequency Distribution, Measures of Centrality, Dispersion of a Distribution</p> <p>Diagnostic Analytics: Correlations, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis: Regression Tools for data science: Introduction, Getting Access to R, Getting Started with R: Basics, Control Structures, Functions, Importing Data</p> <p>Graphics and Data Visualization: Installing ggplot2, Loading the Data, Plotting the Data. Statistics and Machine Learning: Basic Statistics, Regression.</p>	
UNIT-III	10 Hrs
<p>Machine learning for data science: Machine Learning Introduction and Regression: Introduction, Machine Learning, Regression, Gradient Descent. Supervised Learning: KNN classification Unsupervised learning: K means Clustering, Introduction to Reinforcement Learning.</p>	
UNIT-IV	10 Hrs
<p>Applications, Evaluation, and Methods: Hands-On with Solving Data Problems: Introduction, Collecting and Analyzing Twitter Data, Collecting and Analyzing YouTube Data , Analyzing Yelp Reviews and Ratings.</p> <p>Data Collection, Experimentation, and Evaluation: Data Collection Methods: Surveys, Survey Question Types, Survey Audience, Survey Services, Analyzing Survey Data, Pros and Cons of Surveys, Interviews and Focus Groups, Why Do an Interview? Why Focus Groups? Interview or Focus Group Procedure, Analyzing Interview Data , Pros and Cons of Interviews and Focus Groups, Log and Diary Data, User Studies in Lab and Field, Picking Data Collection and Analysis Methods: Introduction to Quantitative Methods, Introduction to Qualitative Methods, Mixed Method Studies. Evaluation: Comparing Models, Training– Testing and A/B Testing, Cross-Validation.</p>	
Reference Books	
<ol style="list-style-type: none"> 1) “Data Science from Scratch”, Joel Grus, O’Rielly Publications, 2015. 2) “ Introduction to Data Science”, Laura Igual and Santi Segui, Springer International Publications, 2017. 	
Text Books:	
<ol style="list-style-type: none"> 1) “A hands on introduction to Data Science”, Chirag Shah, Cambridge University Press, 2020. 	

Course Outcomes: At the end of the course the students should be able to:

1. Identify and assess the needs of an organization for data science task
2. Collect, manage and use data to examine, analyse and interpret data
3. Apply statistical and ML algorithms to effectively generate useful information from structural and unstructured data
4. Design, build and evaluate models that can be used to make predictions in real world phenomena
5. Communicate data science related information effectively in various formats to appropriate audience

21UAI416L	Data Science Lab	Credits:03
L:T:P:3:0:0		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

A. NO.	Assignment
1	Programs on data collection and reading data
2	Programs on data pre processing methods (EDA)
3	Programs on descriptive, diagnostic and predictive analysis.(EDA)
4	Programs on visualization tools (EDA)
5	Program on LR with GD (ML model and its evaluation)
6	Program on KNN classification (ML model and its evaluation)
7	Program on Kmeans clustering (ML model and its evaluation)
8	Program on end to end data science life cycle (case study) on real time data sets