PROGRAMME PROJECT REPORT
OF
DIPLOMA IN DATA SCIENCE
(ODL/ONLINE MODE)

ONE YEAR (TWO SEMESTER) PROGRAMME
Choice Based Credit System on Outcome Based Education
(Effective from Session 2024-25)

CENTRE FOR DISTANCE AND

ONLINE EDUCATION

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE

AND TECHNOLOGY HISAR-125001, HARYANA

(YEAR:2024-25)

PROGRAMME PROJECT REPORT (PPR)
DIPLOMA IN DATA SCIENCE

1. PROGRAMME'S MISSION & OBJECTIVE

1.1 PROGRAMME MISSION:

The Diploma in Data Science aims to develop industry focused professionals with global outlook in software development and testing, web development application, IT and allied sectors. The programme will cover all subsets of data science are descriptive, diagnostic, prescriptive, and predictive. Data Science is the process of collecting, organizing, analyzing, and interpreting data to gain insights that can be used to make informed business decisions. It involves using statistical and quantitative analysis techniques to extract meaningful insights from data and using these insights to improve software performance. By analyzing data from these areas, organizations can identify trends, patterns, and correlations that can help them make informed decisions and optimize their business processes. In view of the huge current as well as potential demand for the professionally qualified persons for the data science sector, and to ensure a steady stream of industry ready professionals at the entry-level, Guru Jambheshwar University of Science & Technology has designed this course as professional qualification who aspire for a career in Data Science.

It is expected that successful candidates of Diploma in Data Science would have a competitive edge and will be absorbed by business analyst expertise, management consulting firms and IT-related firms.

1.2 PROGRAMME OBJECTIVES:

- The objective of the course is to prepare the students as per requirement of industry.
- The course is designed in such a way that business analyst expertise, management consulting firms and IT-related firms can reduce their post recruitment training cost.
- The diploma is backed by a system of high professional standards of the Institute.
- Learner will possess professional skills and competence to solve managerial issues.
- Integrate and apply management theories to practice strategic analysis.
- Use data analytical tools and techniques to identify patterns, develop insights and business strategies.
- Identify, analyze, and practice ethical responsibilities of business.

2. RELEVANCE OF THE PROGRAMME WITH HIGHER EDUCATIONAL INSTITUTION'S (HEI'S) MISSION & GOALS

2.1 HEI'S MISSION:

The University aspires to be a globally recognized Centre of excellence in the field of technical education and research. It strives to achieve this by introducing innovative job-oriented courses, employing competent and motivated faculty, developing state-of-the-art infrastructure, striking purposeful linkages with industry and professional bodies, and promoting quality of work life on campus. The University focuses on the student community to imbue them with passion for knowledge and creativity and to promote sustainable growth in academic resources, student placements, and holistic human development with a strong conviction for professional ethical, social and environmental issues.

2.2 HEI's GOALS

The goals of the University as enshrined in the Act are to facilitate and promote studies and research in emerging areas of higher education with focus on new frontiers of and also to achieve excellence in these and connected fields.

2.3 PROGRAMMES OFFERED TO ACHIEVE HEI'S MISSION AND GOALS

The HEI's mission and goals are holistically inherited in the Diploma in Data Science of Centre for Distance & Online Education. The Scheme and syllabus of this programme is designed by Board of Studies and the same is approved by Academic Council. Latest and updated curriculum is used to meet the Data Science. This programme focuses primarily on data science which is an amalgamation of computer sciences, and technologies that has become one of the most prominent applications of technology in the world This specialization helps to attain the knowledge required to drive key business decisions. It will also help students develop the necessary skills to carry out analytical procedures and support an organization by figuring out ways to improve and optimize existing business processes with ease.

The cost of the programmes and provision for scholarship have been designed with objective of spreading mass education to meet needs of all class of learners. Personal Contact Programme (PCP) is offered by competent faculty as students' support services which ensures timely response to student's queries and, enhances overall quality standards.

3. NATURE OF PROSPECTIVE TARGET GROUP OF LEARNERS

Diploma in Data Science programme for working professionals to enable them to become an exceptional Data Science professional. It covers the concepts of machine learning used as data mining techniques and touches upon the differences between data science and data mining. Students will be able to use the different data mining techniques such as association, clustering, and use different data. Students/Working Professionals who have completed a Senior Secondary are interested in further education may do so by enrolling in online-learning diploma programme. This programme is offered completely through web-based classroom applications, and enrollees can complete all required coursework in order to earn the degree.

- Aspiring executive and working professionals focusing to improve their analytical skills and capabilities for effective decision making.
- People with zeal to learn analytics and its business applications will also find this program as a step-up in enhancing their skills.
- Candidates having strong analytical skills and interest in data crunching can pursue this Data Science programme.
- Working Professionals for gaining add on courses
- Persons who cannot pursue computer education due to any reason
- Persons who are not able to pay higher fees in regular mode (Affordable Fee structure)

4. APPROPRIATENESS OF PROGRAMME TO BE CONDUCTED IN OPEN AND DISTANCE LEARNING (ODL), AND ONLINE MODE TO ACQUIRE SPECIFIC SKILLS AND COMPETENCE

Diploma in Data Science will lead to rewarding careers across the areas of data analytics, Software development, web designing, and other computer science areas, both in India and Abroad. A learner can do this program both as a Fresher and as well as a working professional along with your current job. The online mode provides greater flexibility to the learner with various insights into the management practices with traditional businesses like software testing and development, banking, trading, there is a huge prospect for professionals with management skills and professional degrees.

All the courses in the programme are theoretical and problem based. So, no laboratory or experiment is needed to impart the skills and competence required for the programme. The specific skill and competencies required for a post graduate can be imparted to a great extent through SLM reference books, E-content and E-tutorial prepared with the approach of self-

explanatory self-contained, self-directed, self- motivating and self-evaluating. Centre for Distance and Online Education Department is more costs effective and can take place while continuing full-time employment. The Department offers outcome-based education, having industry centric curriculum. This enables the students to satisfy their needs and aspirations as the system provides enhanced learning opportunities.

4.1 LEARNING OUTCOMES:

In its effort towards contribution of knowledge generation and dissemination the programme is expected to

- Demonstrate an understanding of key terms, theories/concepts and practices within the field of data mining techniques.
- Demonstrate the concepts of Data Science.
- Understanding the differences between data science and data mining
- Apply & analyze the different data mining techniques.
- To nurture creativity and entrepreneurship by gaining business acumen through case studies

5. INSTRUCTIONAL DESIGN

Need based courses have been identified and the courses are developed. They have been fine-tuned taking into consideration industry/social requirements and also to educate rural people professionally. The course, curriculum and syllabi are designed and evaluated by a Departmental Committee. The curriculum and syllabi are then placed in the Board of Studies. The finalized curriculum and syllabi are then placed in the Academic Council for the final approval. In addition, courses have been introduced specifically for CDOE programmes to suit the requirements of the dynamic changes taking place in the economy and Industry. However, courses can be introduced as and when the need arises after obtaining necessary approvals from the appropriate academic bodies of the University. Approval of Board of Studies and Academic Council are obtained whenever modifications/additions are made in the existing curriculum and syllabi.

5.1 CURRICLUM DESIGN

The Diploma in Data Science is a one-year programme divided into two semesters. The course structure, viz, the scheme and syllabus of the Diploma in Data Science is given as under:

Scheme of Diploma in Data Science 2024-25

SEMESTER I

Sr. No.	Paper Code	Nomenclature of the Paper	Credits	Internal Marks	External Marks	Max. Marks
1.	DDS-11-T	Mathematics	3	30	70	100
2.	DDS-12-T	Probability and Statistics	3	30	70	100
3.	DDS-13-T	Data Structures	3	30	70	100
4.	DDS-14-T	Introduction to Data Science	3	30	70	100
5.	DDS-15-T	R Programming	3	30	70	100
6.	DDS-16-P	Data Structures Lab.	2	30	70	100
7.	DDS-17-P	Data Analysis using Excel Lab.	2	30	70	100
8.	DDS-18-P	R Programming Lab.	2	30	70	100
		Total	21	240	560	800

SEMESTER II

Sr. No.	Paper Code	Nomenclature of the Paper	Credits	Internal Marks	External Marks	Max. Marks
1.	DDS-21-T	Database Management System	3	30	70	100
2.	DDS-22-T	Artificial Intelligence	3	30	70	100
3.	DDS-23-T	Machine Learning	3	30	70	100
4.	DDS-24-T	Python Programming	3	30	70	100
5.	DDS-25-T	Data Analytics	3	30	70	100
6.	DDS-26-P	Python Programming Lab.	2	30	70	100
7.	DDS-27-P	Data Analytics Lab.	2	30	70	100
8.	DDS-28-MP	Major Project	8	30	70	100
		Total	27	240	560	800

Note: To be eligible for the award of the Diploma in Data Science, a student has to complete all the 16 courses as shown in the above tables. However, a candidate can take exit option after 6 months (Semester I) and upon successful completion he/she will get Certificate in Data Science. The question papers for the final examination will be objective type.

Mathematics

General Course Information

Course Code: DDS-11-T Course Credits: 3	Course Assessment Methods:
Exam Duration: 90 Minutes	Max. Marks: 100
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Matrices Elementary row transformations – rank – echelon form, normal form – solutions of linear system of homogenous and non homogeneous equations.

Unit II

Eigen Values, Eigen vectors Eigen values, eigen vectors – properties – cayley – hamilton theorem – inverse and power of a matrix by cayley – hamilton theorem;
Quadratic forms Linear transformation – reduction of quadratic form to canonical form and their nature (rank, signature and index).

Unit III

Mean value theorems Rolle's theorem – lagrange's mean value theorem – (excluding proof). Simple examples of taylor's and maclaurin's series. maxima and minima of functions of two variables - lagrange method of multipliers with three variables only.

Unit IV

Multiple integrals Evaluation of double integrals (cartesian and polar) – change of variables – change of order of integration – changing into polar coordinates – evaluation of triple integrals.

Text and Reference Books:

1. T.K.V. Iyengar, B. Krishna Gandhi, Mathematical Methods, S. Chand & Company.
2. T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – I, S. Chand & Company.
3. T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – III, S. Chand & Company.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.

Probability and Statistics

General Course Information

Course Code: DDS-12-T Course Credits: 3	Course Assessment Methods:
Exam Duration: 90 Minutes	**Max. Marks: 100**
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I
Probability: Sample Space and events – Probability – The axioms of Probability – Some Elementary theorems – Conditional Probability – Baye's theorem.

Unit II
Random Variables: Discrete and continuous - Distribution – Distribution functions – Properties – Discrete Random variables – Probability mass function – Continuous Random variables – Probability density function.

Unit III
Binomial, Poisson and Normal distributions – Related properties – Fitting distributions. Sampling distribution : Population and samples – Sampling distribution of mean (known and unknown) Estimation: Point estimation – Interval estimation – Bayesian estimation..

Unit IV
Test of Hypothesis – Means – Proportions – Hypothesis concerning one and two means – One tail, two tail tests – Type I and Type II errors; Tests of significance – Student's t –test, F – test.

Text and Reference Books:
1. T.K.V. Iyengar, B. Krishna Gandhi and others, Probability and Statistics, S.Chand and company.
2. Dr. Shahnaz Bathul, A Text book of Probability and Statistics, Cengage Learning India Pvt Ltd
3. B.V. Ramana, Engineering Mathematics, Tata McGraw Hill .

Data Structures

General Course Information

Course Code: DDS-13-T Course Credits: 3	Course Assessment Methods:
Exam Duration: 90 Minutes	Max. Marks: 100
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I
Introduction to data structures and their types, Abstract data types, Linear lists: Arrays and linked lists: memory representations, implementing operations like traversing, searching, inserting and deleting etc. Applications of arrays and linked lists.

Unit II
Stack and Queue: Static and linked implementations, Operations and Applications. Type of queues. Circular queues, De-queue, Priority Queues.
Application of stacks: Infix to postfix Transformation, Evaluating Arithmetic Expressions.

Unit III
Trees: Binary Trees, terminology, representation and traversals- pre, post & in-order traversals. Binary Search Trees implementation and operations.
Graphs: Graph definitions and related terminology, memory representations for graphs and associated algorithms for searching, inserting and deleting nodes and related algorithms, Graph traversals and applications (DFS, BFS).
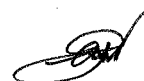
Unit IV
Sequential and Binary search, Sorting algorithms: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Internal and external sorting and stable sorting techniques.
Heapsort - Heaps, Maintaining the heap property, Building a heap, heapsort algorithm

Text and Reference Books:
1. A. Tanenbaum, Y. Lanhgsamand A. J. Augenstein, "Data Structures Using C", PHI.
2. Seymour Lipschultz, "Theory and Practice of Data Structures", Tata McGraw-Hill.
3. G. S. Baluja, Data Structures through C, 4th Edition – Dhanpat Rai & Co.

Introduction to Data Science

General Course Information

Course Code: DDS-14-T Course Credits: 3	Course Assessment Methods:
Exam Duration: 90 Minutes	Max. Marks: 100
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Introduction to data Science: Data science definition, Basic terminology in data science, Difference between data, data science, big data, mathematical statistics and artificial intelligence, Venn diagram of data science, Data science application areas, Importance of data in decision making. History of data science: origin of data science, key milestone from statistics to machine learning, Modern development in AI and big data, Interdisciplinary nature of data science.

Unit II

Role of data in modern world: Data and its importance in business, Data driven decision making, Impact of data on various domains, Data privacy. Data collection and data sources: Methods of primary and secondary data collection, Survey techniques, public datasets, APIs and web scraping, Ethics in data collection. Types of data: structured, unstructured, semi structured Measurement scale of data. Various types of databases and datasets such as multimedia data, social media data, biological data, sensor data and operation using python.

Unit III

Data Science Methodology: Components of data science methodology, Methodology in data science, challenging in applying methodologies, Data Science Life Cycle: Phase in data science lifecycle: discovery, data preparation, model planning, model building, model evaluation, deployment.

Unit IV

Exploratory Data Analysis: Objectives of data exploration, Common techniques for exploratory data analysis, Data visualization: Basic visualization operation, line plot, bar chart, scatter plot, Advanced visualization techniques: heatmap, box plot, pair plot, Basic introduction to data science tools: Python, R.

Text and Reference Books:

1. Data Science: Concepts and Practice, Vijay Kotu, Bala Deshpande, Morgan Kaufmann; 2nd edition (2018)
2. The Art of Data Science, Roger Peng , Elizabeth Matsui, Lulu.com (2016)
3. John D. Kelleher and Brendan Tierney, Data Science. The MIT Press, 2018.
4. Murtaza Haider, Getting Started with Data Science: Making Sense of data with analytics. IBM Press, 2015.
5. Field Cady, The Data Science Handbook, John Wiley & Sons, 2017.
6. Laura Igual and Santi Seguí, Introduction to Data Science, Springer International Publishing, 2017. 7. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Media, Inc. 2014.

R Programming

General Course Information

Course Code: DDS-15-T Course Credits: 3	**Course Assessment Methods:**
Exam Duration: 90 Minutes	**Max. Marks: 100**
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Introduction to R: What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R- Input and Output – Entering Data from keyboard – Printing fewer digits or more digits

R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame
R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables
R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators

Unit II

R Decision Making: if statement, if – else statement, if – else if statement, switch statement
R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.
R-Function: function definition, built in functions: mean (), paste (), sum (), min (), max (), seq (), user-defined function, calling a function, calling a function without an argument, calling a function with argument values
R-Strings – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower()

Unit III

R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting
R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector
R Matrices – Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division
R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements

Unit IV

Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge()

Visualization: Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.

Text and Reference Books:

1. Saroj Dahiya Ratnoo, Himmat Singh Ratnoo , ESSENTIALS OF R FOR DATA ANALYTICS, Wiley, January 2021
2. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017
3. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018
4. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015

Data Structures Lab.

General Course Information

Course Code: DDS-16-P	Course Assessment Methods:
Course Credits: 2	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

List of Experiments

1. Perform Linear Search and Binary Search on an array.
   a. Read an array of type integer.
   b. Input element from user for searching.
   c. Search the element by passing the array to a function and then returning the position of the element from the function else return -1 if the element is not found.
   d. Display the position where the element has been found.
2. Implement sparse matrix using array. Description of program:
   a. Read a 2D array from the user.
   b. Store it in the sparse matrix form, use array of structures.
   c. Print the final array.
3. Create a linked list with nodes having information about a student and perform
   a. Insert a new node at specified position.
   b. Delete of a node with the roll number of student specified.
   c. Reversal of that linked list.
4. Create doubly linked list with nodes having information about an employee and perform Insertion at front of doubly linked list and perform deletion at end of that doubly linked list.
5. Create circular linked list having information about an college and perform Insertion at front perform Deletion at end.
6. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list.
7. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
8. Create a Binary Tree (Display using Graphics) perform Tree traversals (Preorder, Postorder, Inorder) using the concept of recursion.
9. Implement insertion, deletion and display (inorder, preorder and postorder) on binary search tree.
10. To implement Quick sort, and Bubble sort using array as a data structure.

Data Analysis using Excel Lab.

General Course Information

Course Code: DDS-17-P	Course Assessment Methods:
Course Credits: 2	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

List of Experiments

Experiment:1
- a.   Study functions and features of Microsoft Excel
- b.   Getting started with excel: Opening a blank or new workbook, general organization
- c.   Highlights and main functions: Home, Insert, page layout, formulas
- d.   Highlights and main functions: Data, review, view, add-inns

Experiment: 2
- a.   Customizing the Quick Access Toolbar,
- b.   Working with Data: Entering, Editing, Copy, Cut, Paste, Paste Special

Experiment: 3
- a.   Manipulating Data, using Data Names and Ranges, Filters and Sort and Validation Lists
- b.   Data from External Sources
- c.   Basic Formulas and Use of Functions
- d.   Data Analysis Using Charts and Graphs

Experiment: 4

Advanced Formulas and Functions, Advanced Worksheet Features

Experiment: 5

Advanced Data Analysis using PivotTables and Pivot Charts

Experiment: 6
- a.   Tabulation
- b.   Bar diagram
- c.   Multiple Bar diagram
- d.   Pie diagram

Experiment: 7

Measure of central tendency: Mean, median, mode

Experiment: 8
- a.   Measure of dispersion: variance, standard deviation, Coefficient of variation
- b.   Correlation, regression lines

Experiment: 9

t-test, F-test

Experiment: 10

ANOVA one way classification

Experiment: 11

t-test , F-test, ANOVA one way classification, chi square test, independence of attributes.

Experiment: 12

Chi square test, independence of attributes

Experiment: 13

Time series: forecasting Method of least squares

Experiment: 14

Moving average method, Inference and discussion of results

R Programming Lab.

General Course Information

Course Code: DDS-18-P	Course Assessment Methods:
Course Credits: 2	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

List of Experiments

1. Introduction to R and RStudio:

   Install R and RStudio.

   Explore RStudio interface, command prompt, script files, and comments.

2. Handling Packages in R:

   Install and load packages.

   Use commands: installed.packages(), packageDescription(), help(), find.package(), library().

3. Input and Output Operations:

   Enter data from the keyboard.

   Print fewer or more digits.

4. R Data Types:

   Work with vectors, lists, matrices, arrays, factors, and data frames.

5. Variable Management in R:

   Variable assignment and type identification.

   Use ls() to list variables and rm() to delete variables.

6. R Operators:

   Perform operations with arithmetic, relational, logical, assignment, and miscellaneous operators.

7. Decision Making in R:

   Implement if, if-else, if-else if, and switch statements.

8. Looping Constructs in R:

   Use repeat, while, and for loops.

   Control loops with break and next statements.

9. Functions in R:

   Define and call built-in and user-defined functions.

   Experiment with functions: mean(), paste(), sum(), min(), max(), seq().

10. String Manipulations:

    Use substr(), strsplit(), paste(), grep(), toupper(), tolower().

11. Vector Operations:

    Create and manipulate vectors.

12. List Operations:

    Create, access, and modify lists.

    Merge lists and convert lists to vectors.

13. Matrix Operations:

    Access matrix elements.

    Perform addition, subtraction, multiplication, and division.

14. Array Manipulations:

    Name and access array elements.

    Perform calculations across arrays.

15. Data Frame Operations:

    Create, access, and modify data frames.

    Use functions: dim(), nrow(), ncol(), str(), summary(), names(), head(), tail(), edit().

16. Joining and Merging Data Frames:

    Use rbind(), cbind(), and merge() functions.

17. Data Visualization:

    Create pie charts, histograms, density plots, and bar charts.

Database Management System

General Course Information

Course Code: DDS-21-T Course Credits: 3 Exam Duration: 90 Minutes	**Course Assessment Methods:** **Max. Marks: 100** **(Internal Marks: 30; External: 70)** The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Overview: Overview of File Systems and Database Systems, Characteristics of the Data Base Approach, Database users, Advantages and Disadvantages of a DBMS.
Data Base Systems Concepts and Architecture: DBMS architecture and various views of Data, Data Independence, Database languages.

Unit II

E-R Model: Entity Types, Attributes & Keys, Relationships, Roles and Structural Constraints, E-R Diagrams.
Relational Model and Query Language: Overview of Relational Database, Key Integrity Constraints, Relational Algebra, SQL fundamentals, Basic Operators, Missing information and NULL values.

Unit III

Relational Database Design: Overview of normalization, Database Anomalies, Candidate and Super Key, Functional Dependencies, Integrity Constraints, Decomposition, Normal forms: First, Second, Third Normal, Boyce Codd, Normal Form.

Unit IV

Concurrency Control Techniques: Overview of database Transactions, Transaction states, ACID properties of a Transaction, Transaction Recovery, Concurrency Control, Locking Techniques, Time stamp ordering, Deadlock, Recovery Techniques in centralized DBMS.

Text and Reference Books:

1. Elmasri, R., and Navathe, S. B., Fundamentals of Database Systems, 7th Edition, Pearson.
2. Silberschatz, A., Korth, H. F., and Sudarshan, S., Database System Concepts, McGraw Hill, 2011.
3. Pannerselvam R., Database Management Systems, 2nd Edition, PHI Learning, 2011.
4. Desai, B. C., An Introduction to Database System, Galgotia Publication, 2010.
5. Leon, A., and Leon, M., Database Management Systems, 1st Edition, Vikas Publishing, 2009.
6. Mata-Toledo, R., Cushman, P., Sahoo, D., Database Management Systems, Schaums' Outline series, TMH, 2007.

Artificial Intelligence

General Course Information

Course Code: DDS-22-T Course Credits: 3	**Course Assessment Methods:**
Exam Duration: 90 Minutes	**Max. Marks: 100**
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I
Overview of Artificial Intelligence: Introduction to AI, Importance of AI, AI and its related field, Turing Test, AI techniques, Problems, Problem Space and search: Defining the problem as a state space search, Production system and its characteristics.

Unit II
Search Techniques: Depth first search, Breadth First Search, Heuristic Search Technique: Generate and test, Hill climbing, best first search technique, A* algorithm, Searching of AND/ OR graph using AO* algorithm.

Unit III
Logic: Propositional Logic, Syntax of propositional Logic, Predicate Logic, Representing facts in logic, Normal forms in logic, clause form, Unification, Resolution in predicate logic.
Knowledge representation: Significance of Knowledge representation, Semantic Networks, Frames.

Unit IV
Fuzzy logic systems: Introductions, fuzzy sets, fuzzy logic, fuzzy rules, fuzzy reasoning.
Probabilistic reasoning: Need of probabilistic reasoning, Probability and Baye's theorem, Bayesian belief Networks.

Text and Reference Books:
1. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial intelligence, McGraw Hill Education, 2009.
2. Rajiv Chopra, Artificial Intelligence (A Practical Approach), S Chand Publishing, 2012.
3. Stuart Russel and Peter Norvig, Artificial intelligence: A modern Approach, Pearson Education, 2015.
4. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, Pearson Education.1st edition, 2007.
5. Deepak Khemani, A first course in Artificial Intelligence, McGraw Hill Education. 3rd edition, 1st edition, 2013.
6. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 5th edition, 2009

Machine Learning

General Course Information

Course Code: DDS-23-T Course Credits: 3 Exam Duration: 90 Minutes	Course Assessment Methods: Max. Marks: 100 (Internal Marks: 30; External: 70) The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Introduction: What is machine learning? Types of machine learning, Examples of machine learning applications: learning associations, classifications, regression, unsupervised learning, reinforcement learning.
Unsupervised learning: k-mean clustering, self organizing feature map (SOM algorithm)
Dimensional Reduction: Principal Component Analysis.

Unit II

Decision tree: Introduction, decision tree representation, appropriate problem for decision tree learning algorithm, basic decision tree learning algorithm, entropy measures, information gain measures, Example problem for illustrating ID3.
Regression: Linear regression, linear regression examples.

Unit III

Artificial neural network: Introduction, biological motivation, neural network representation, appropriate problem for neural network learning, perceptron, representation power of perceptron, perceptron training rule, gradient descent and delta rule, multilayer network and backpropagation algorithm, a differentiable threshold unit, the backpropagation algorithm, convergence and local minima, deep learning.

Unit IV

Bayesian learning: Introduction, Bayes theorem, Naive Bayes classifiers.
Instance based learning-nearest neighbour learning, remarks on k-nearest neighbour algorithm.
Support Vector Machines: optimal separation, kernels, extensions to the support vector machine

Text and Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill 1997
2. Bishop Christopher, Pattern Recognition and Machine Learning Springer Verlag 2006
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction , Springer, 2nd edition 2009
4. J. Han and M. Kamber, Data Mining Concepts and Techniques, Elsevier, 3rd Edition 2012
5. S. Rajeshkaran, G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI 2003

Python Programming

General Course Information

Course Code: DDS-24-T Course Credits: 3 Exam Duration: 90 Minutes	**Course Assessment Methods:** **Max. Marks: 100** **(Internal Marks: 30; External: 70)** The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I

Introduction to Python, History of Python, Features of Python, Python Identifiers, Python Character Set, Keywords and Indentation, Comments, Command Line Arguments, Assignment Operator, Operators and Expressions, print() Function, input() Function, eval() Function. Python Data Types: int, float, complex, Variables, Mutable vs Immutable variables, Namespaces, Decision Statements: Boolean Type, Boolean Operators, if statement, else statement, Nested Conditionals Statements, Multi-way Decision Statements (elif statement).

Unit II

Loop Control Statements: While loop, range() Function, For Loop, Nested Loops, Infinite Loop, Break Statement, Continue Statement, Pass Statement, Introduction to Strings, String Operations: Indexing and Slicing, Lists: Operations on List: Slicing, Inbuilt Functions for Lists, List Processing: Searching and Sorting, Dictionaries: Need of Dictionary, Operations on Directories: Creation, Addition, Retrieving Values, Deletion; Tuples, operations on Tuples, Inbuilt Functions for Tuples, Introduction to Sets, operations on sets.

Unit III

Python Functions, Inbuilt functions, Main function, User Defined functions, Defining and Calling Function, Parameter Passing, Actual and Formal Parameters, Default Parameters, Global and Local Variables, Recursion, Passing Functions as Data, Lamda Function, Modules, Importing Own Module, Packages.
Operations on File: Reading text files, read functions, read(), readline() and readlines(), writing Text Files, write functions, write() and writelines(),Manipulating file pointer using seek, Appending to Files.

Unit IV

Python Object Oriented: Overview of OOP, Classes and objects, Accessing attributes, Built-In Class Attributes, Methods, Class and Instance Variables, Destroying Objects, Polymorphism, Overlapping and Overloading of Operators, Class Inheritance: super(), Method Overriding, Exception Handling, Try-except-else clause, Python Standard Exceptions, User-Defined Exceptions

Text and Reference Books:

1. Martin C. Brown, "Python: The Complete Reference" McGraw Hill Education,

Fourth edition , 2018
2. R. Nageswara Rao , "Core Python Programming" Dreamtech Press India Pvt Ltd 2018.
3. Ashok Namdev Kamthane, Programming and Problem Solving with Python, Mc Graw Hill Education Publication, 2018.
4. John Guttag, Introduction to Computation and Programming using Python, Springer
5. Lutz, M., Learning Python: Powerful Object-Oriented Programming. O'Reilly Media, Inc., 2013.
4. Michael T Goodrich and Robertto. Thamassia, Micheal S Goldwasser, Data Structures and Algorithms in Python, Wiley, 2016.
6. Y. Daniel Liang, Introduction to Programming Using Python, Pearson, 2013.
7. Reema Thareja, Python Programming Using Problem Solving Approach , Oxford Publications, 2017.
8. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning, 2011.

Data Analytics

General Course Information

Course Code: DDS-25-T Course Credits: 3	Course Assessment Methods:
Exam Duration: 90 Minutes	Max. Marks: 100
	(Internal Marks: 30; External: 70)
	The examiner is required to set a total of 70 Multiple Choice Questions (MCQs), with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The question paper may contain various types of MCQs, including those with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types. There will be no negative marking.

Course Content

Unit I
Introduction: Importance of Data Analytics, Types of Data Analytics, Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Benefits of Data Analytics, Data visualization and decision Making.

Unit II
Introduction to simple Linear Regression: The Regression Equation, Introduction to Multiple Linear Regression: Assessing the Model, Cross-Validation, Logistic Regression: Logistic Response function and logit, Logistic Regression.

Unit III
Mining Data Streams: Stream Data Model and Architecture, Stream Computing, Sampling Data in a stream, Filtering Streams, Counting Distinct Elements in a stream, Estimating Moments, Counting Oneness in a window, Real Time Analytics Platform (RTAP) Applications.

Unit IV
Data analytics and visualization with R and Python: Attribute and Data type, Descriptive statistics. Exploratory Data Analysis: Visualization before analysis, DirtyData, visualizing single variable, examining Multiple variable, Data Exploration versus presentation.

Text and Reference Books:
1. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education services Wiley Publication
2. Bharati Motwani, Data Analytics using Python, Wiley Publications.
3. Bharati Motwani, Data Analytics using R, Wiley Publications
4. Andrew Bruce, Peter Bruce, and Peter Gedeck, Practical Statistics for Data Scientists 50+ Essential Concepts Using Rand Python, O'Reilly Publications 2nd Edition

5. A, Rajaraman, J.D. Ullman, Mining of Massive Datasets, Cambridge University Press, 2012
6. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining, Concepts and Techniques: 3rd edition,
7. Wes McKinney, Python for Data Analysis: 3rd Edition, O'Reilly Media, Inc.

Python Programming Lab.

Python Programming Lab.

General Course Information

Course Code: DDS-26-P	Course Assessment Methods:
Course Credits: 2	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

List of Experiments

1. Install Python and explore various popular IDE like IDLE, PyCharm, and Anaconda.
2. Assignments to perform various number operations like
   a. Find maximum from a list of numbers
   b. GCD of two number
   c. Square root of a number
   d. Check number is prime or not.
   e. Print first N prime numbers
   f. Remove duplicate numbers from list
   g. Print the Fibonacci series.
3. Assignments to perform various operations on Strings like creation, deletion, concatenation.
4. Create a List L = [10, 20, 30]. Write programs to perform following operations:
   a. Insert new numbers to list L.
   b. Delete numbers from list L.
   c. Sum all numbers in list L.
   d. Sum all prime numbers in list L.
   e. Delete the list L.
5. Create a Dictionary D= {'Name': 'Allen', 'Age': 27, 5:123456}. Write programs to perform following operations:
   a. Insert new entry in D.
   b. Delete an entry from D.
   c. Check whether a key present in D.
   d. Update the value of a key.
   e. Clear dictionary D.
6. Two assignments on Sets to perform various operation like union, intersection, difference etc.
7. Two assignments related to searching operation like linear search, binary search.
8. Three assignments related to sorting like selection sort, bubble sort, insertion sort.
9. Demonstrate the use of dictionary for measuring student marks in five subjects and you have to find the student having maximum and minimum average marks.
10. Two assignment on usage of different available packages like random package to perform
    a. Print N random numbers ranging from 100 to 500.
    b. Print 10 random strings whose length between 3 and 5.
11. Implement and demonstrate the functions of a simple calculator.
12. One assignment on implementing object oriented concept such as classes, inheritance, and polymorphism.

Data Analytics Lab.

General Course Information

Course Code: DDS-27-P	Course Assessment Methods:
Course Credits: 2	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

List of Experiments

1. Write a program in python for cleaning and handling missing values in dataset and data normalization.
2. Write a program to perform descriptive statistics.
3. Write a program for creating line charts, bar plots, scatter plots, and histograms.
4. Write a program for hypothesis testing.
5. Write a program for linear regression analysis.
6. Write a program for logistic regression analysis.
7. Write a program for binary classification.
8. Write a program for model evaluation using accuracy, precision, recall, F1-score.
9. Write a program for test processing.
10. Write a program for cross validation.

Major Project

General Course Information

Course Code: DDS-28-MP	Course Assessment Methods:
Course Credits: 8	Max. Marks: 100
Exam Duration: 3 hours	(Internal Marks: 30; External: 70)

Students are required to complete their project work in the domain of Data Science by the end of 2nd semester. Students carry out implementation of their respective projects based on the problem identified, methodology and tools suggested in the synopsis submitted in the second week in the starting of 2nd semester. They prepare the final project reports according to the format provided. At the end of 2nd semester, each student is required to present his/her project work in front of internal project guide and external examiner appointed by Controller of Examination.

5.3. DURATION OF PROGRAMME

The duration of the Diploma in Data Science is one year and the maximum duration is three years.

1. A student who for whatever reasons is not able to complete the programme within the normal period or the minimum duration prescribed for the programme shall be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. The general formula, therefore, will be as follows:

   a) Time span = N+2 years for the completion of programme. Where N stands for the normal or minimum duration prescribed for completion of the programme.

   b) In exceptional circumstances a further extension of one more year may be granted. The exceptional circumstances are spelt out clearly by the relevant statutory body of the University.

2. Further, the mercy chance, if any will be given within maximum allowed period of the programme as per UGC guidelines. In normal circumstances, only two chances will be given to pass re -appear examination.

5.4 FACULTY AND SUPPORT STAFF

FACULTY

The Centre for Distance & Online Education (CDOE) have qualified teaching faculty to look after the programme as a programme coordinator. They look for the following activities related to the distance education:

- Conducting Personal Contact Programme (PCP) classes for the students.
- Assisting in the change of Regulations and Curriculum, admission work, counseling new students and other issues such as break of study, exemptions etc.
- Coordinating for the preparation of study materials for all semesters/year.
- Coordinating with the faculty members for the preparation and evaluation of assignments of students, and viva voce examinations.

SUPPORT STAFF

The Centre for Distance and Online Education (CDOE) of the university is headed by the director who is a full-time faculty member (Professor) of the university appointed by Vice-Chancellor to facilitate the development, implementation and monitoring the programmes offered at CDOE and to attend all administrative matters concerned with the activities of directorate. The supporting staffs such as one Deputy Registrar, one Assistant Director, one

Superintendent, two Deputy Superintendent, one Hindi Officer, Six Assistants and other clerical staff are coordinating the activities of Centre for Distance and Online Education (CDOE) and looks after the problems of the students. The Supporting staff looks after the problems of the students through online admission help line, examination related work, study material delivery, grievance redressal and so on. The CDOE is assisted by the IT CELL for the online uploading and evaluation of assignments and other student support activities. The CDOE also assisted by Pt. Deendayal Upadhyaya Computer and Informatics Centre (PDUCIC) department for communicating important information to the students through CDOE website of Guru Jambheshwar University of Science and Technology, Hisar. The PDUCIC department managed the CDOE Website of the University. There are six faculties of commerce & management in the Centre for Distance and Online Education who are looking after the programme as programme coordinator(s) and course co-ordinator(s). Further, support from faculties of parent teaching department

5.5 INSTRUCTIONAL DELIVERY MECHANISM

The Instructional delivery mechanisms of the University for ODL/online courses different components, viz, SLM, Personal Contact Programme (PCP), E-Content, E-Tutorial, Internal Assignments and End Term Examination.

- **Self Learning Material–** The success and effectiveness of the department largely depends on the e-content in the form of self-learning mode (SLM). So, it is necessary that the online study material must be ideal for easy and better understanding. Learning Material through electronic media named Self-learning Material (SLM) is developed with the approach of self-explanatory, self-contained, self-motivating and self-evacuating followed by the UGC guidelines.

- **Personal Contact Programme-** PCP sessions guide the learners as the prgramme proceeds. The PCP schedule is communicated to the learners through our website or Email service. During PCP, the learner gets guidance for better understanding of the programme and subject. The Personal Contact Programme (PCP) is arranged for each of the course by respective Programme Coordinator. The learners get their doubts cleared with the help of subject experts sop as to improve their self-learning capability. Learners are required to attend PCP sessions for all their respective subjects.

- **E-Contents–** The success and effectiveness of online distance education systems largely depends on the e-content in the form of self-learning mode (SLM). So, it is necessary that the online study material must be ideal for easy and better understanding. Learning Material

through electronic media named Self-learning Material (SLM) is developed with the approach of self-explanatory, self-contained, self-motivating and self-evacuating followed by the UGC guidelines. Beside this, the E-content also may include e-book, illustrations, case studies, presentations and web resources such as further references, related links, open-source content on internet, video, case studies, research papers, journals, anecdotal information, articles, historical development of the subject etc.

- **E-Tutorial** – E-Tutorial in the form of video-audio lectures, PPTs, virtual labs etc., guide the learners for better insights on subject matters. It shall be the responsibility of the programme coordinator to ensure that none of the graphics, animation, images, sound clips, video clips used are plagiarized or cited without formal permission from owners. The information for the e-tutorial is communicated to the learners through our website or SMS Services. During e-tutorial, the learner gets guidance for better insights of the subject. A five credit course shall typically have 20 hours of video content and 20 hours of reading material.

- **Discussion Forum:** The facility of discussion forum also provided for raising of doubts and clarifying the same on real time basis for programme by the respective Programme Coordinator and his/her team. The learners get their doubts cleared with the help of subject experts so as to improve their self- learning capability. Learners are required to attend e-tutorial as well as discussion forum sessions for all their respective subjects. The mentor shall be the subject matter expert adept in handling technology. The Programme coordinator and mentor shall need to participate actively in discussion forum. Apart from discussion forum other interactive platforms like web conferencing may also be used.

- **Internal Assessments-** Centre for Distance and Online Education learners have to depend much on self-study. In order to ascertain the writing skill and level of comprehension of the learner, assignment work is compulsory for all learners. The Centre for Distance and Online Education (CDOE) of this university has an online portal for the uploading of the assignments and same has been evaluated online by the subject expert. Two assignments of 30 marks i.e. 15 marks each is allotted for each subject consists of questions with practical based. The assignment question papers are uploaded on the website within a scheduled time and the learners are required to respond them within a specified period of time. The response of the learner is examined by a faculty member.

- **End Term Examination-** At the end of every session, the learner will give a theory examination that will be worth 70 marks for each subject. For Open and Distance Learning

(ODL) and online mode examinations, the format may include either computer-based tests or pen-and-paper tests in a proctored environment at designated exam centers, with all necessary security arrangements ensuring transparency and credibility of the examinations. Online examinations may also be conducted through technology-mediated proctoring. The question paper format may include Multiple Choice Questions (MCQs) totaling seventy (70) marks. The examiner is required to set a total of 70 multiple-choice questions, with a minimum of 17 questions from each unit. The student is required to attempt all the questions. All questions carry equal marks. The maximum time allotted for the major exam is 90 minutes. The question paper may contain MCQs with single correct answers, multiple correct answers, ascertaining and reasoning questions, single correct answers with multiple choices, and matching types, among others. There will be no negative marking.

5.6 STUDENT SUPPORT SERVICES

The department of the university provides the Student Support Services through online mode. Following are the main student support services provided by university through online mode:

- Online Admission Portal for students
- Online fee portal for students
- SMS alert facility for the students for information related to PCPs, Project, Deadlines and Viva-voce etc.
- Grievance handling mechanism is adopted with the help of supporting technical staff
- Practical Questions Based Assignments
- Online availability of Old Question Papers and study material
- Comprehensive viva-voce is conducted after term end examination in the University
- Student Help Desk

6. PROCEDURE FOR ADMISSIONS, CURRICULUM TRANSACTION AND EVALUATION

6.1 PROCEDURE FOR ADMISSIONS

6.1.1 Admission Procedure

Whole admission process is online as per the University rules.

6.1.2 Admission policy for the programme

Admission is based on filling online Admission Form. The procedure of filling the online application form is a four-step procedure, i.e.

- Candidate Registration.
- Payment option through Net Banking, Debit card or Credit card.
- Filling of application form.
- Uploading required scanned documents.
- Generating Preview

6.1.3 Eligibility

Sr. No.	Title of Programme	Eligibility
1.	Diploma in Data Science	12th pass in any discipline

6.1.4 Fee structure

Diploma in Data Science (ODL Mode)

Installment No.	Amount	Without late fee	With late fee of ₹ 1000/- per month
1st Installment	₹ 10,000/-	At the time of admission	-
2nd Installment	₹ 8,000/-	31st January every year	30th April every year

Diploma in Data Science (Online Mode)

Installment No.	Amount	Without late fee	With late fee of ₹ 1000/- per month
1st Installment	₹ 12,000/-	At the time of admission	-
2nd Installment	₹ 10,000/-	31st January every year	30th April every year

6.1.5 Curriculum Transaction

The Centre for Distance and Online Education supply study material in the form of self learning mode (SLM), printed books/lessons as well as in the electronic form. The students get the same directly from the department either by hand or will be sent by post/courier service. Similarly, soft copy of the SLM is uploaded on the CDOE website. Personal contact programme (PCP) for students is also arranged by the expert teachers to resolve the queries and doubt regarding the syllabus. E-tutorial for programme is arranged for each semester by the respective Programme Coordinator. Theory/Practical teaching as per requirements will be provided to the students by the subject specialists. Video lectures are also provided to the students on their LMS portal. The e-tutorial held as per the schedule given in the prospectus. In addition to this student are informed about e-tutorial and other activities through website and mail as well.

6.1.5 Evaluation

Internal assessment will be based on practical assignments and the evaluation will be done by experts in relevant field. External term end examination will be of objective type questions of 70 marks.

Last Date of online submission of Internal Assignments

Odd Semester	Even Semester
15th January every year	30th April every year
Last Date of submission of Internal Assignment with a late fee of Rs. 500/-	
31st January every year	31st May every year
Last Date of submission of Internal Assignment with a late fee of Rs.1000/-	
15th February every year	15thJune every year

NOTE:

1. The students have to upload two internal handwritten assignments of each theory paper of 30% weightage in the stipulated time period mentioned above. Assignments will be prepared by the students will be available on the CDOE website and student portal/LMS as well. It is the sole responsibility of the student to download the question paper of the assignment and upload the solved assignments.

2. The students who fail in internal assessment as well as in aggregate will have the option to improve their score in the internal assessment giving a special chance to such students.

3. A student who could not score 40% marks in external examination of the particular course will have to reappear in the external examination of the respective paper as per university rules in this connection.

7. REQUIREMENT OF THE LABORATORY SUPPORT AND LIBRARY RESOURCES

7.1 Laboratory Support:

A well-equipped Computer lab with latest version of MS Office and internet facility is also available in the department of Centre for Distance and Online Education of this university. This Computer Lab is established with an aim to meet the computing requirements of all the learners of the University. This lab is equipped with 12 desktop computers of latest configuration i.e. Window 7, Window 10 and I3 processor. In addition to this, there is one printer, one scanner and one LED in the Computer Lab for teaching through presentation and video lectures to

students. There is one lab attendant for handling the queries regarding online admission, fee payment, uploading of assignments, any other queries through mail, etc.

7.2 Library Resources:

The infrastructure related to library resources is available in the present set-up of the university whereby, we have a well stacked library with latest books, journals, magazines and newspapers. It is named after the great Indian Jurist, Economist, Politician and Social reformer Dr. Bhim Rao Ambedkar. The seating capacity of the University Library is 400 seats. By the end of December 2018, the Library has a collection of 106566 books. The library in its electronic repository has the access to 7000+ e-journals from 14 publishers and 5 Databases. Moreover, 2149 e-books of national and international repute publishers have also been added in e-repository to enrich the students, but within the university premises. University library provides different services to distance learners such as Air-Conditioned Reading Halls, Reading Facility for 400 students, Laptop Lab for SC/ST students consisting of 20 Laptops with internet facility and Potable Water facility on every floor. The online e-library resources namely INFLIBNET is also available for the accessibility of books and journals.

8. <u>COST ESTIMATE OF THE PROGRAMME AND THE PROVISIONS</u>

Cost estimates of programme are based on following components:

- Study Material development and delivery such as cost of writing, vetting, editing, SLM conversion, printing and dispatch etc.
- Personal Contact Programme (PCP) related activities
- E-tutorial/Video Lectures
- Proctored examination and evaluation
- Internal assessment preparation and evaluation
- Miscellaneous cost like advertising on FM radio broadcast, newspapers and SMS alert
- Salary to Teaching and Non–Teaching Staff

9. <u>QUALITY ASSURANCE MECHANISM</u>

9.1 Quality Policy of University:

The Guru Jambheshwar University of Science & Technology (GJUST) is committed to achieve excellence in teaching, research, and extension by follow and implement following points of quality policy:

- Imparting globally competitive education

- Selecting and retaining competent and motivating faculty
- Providing state or the art infrastructural resources
- Promoting quality research culture
- Ensuring transparent and accountable governance
- Focusing on holistic development of learners
- Symbiotic relationship with industry, other academic institutions, and society
- Striving for financial self-reliance

9.2 Advisory Committee:

The Advisory Committee headed by the Vice-Chancellor has been constituted to monitor the activities of the Department along-with matters related to quality assurance (Functions and List of members attached). Following is the composition of Advisory Committee:

Vice-Chancellor, GJUS&T, Hisar	Chairman
Registrar, GJUS&T, Hisar	Member
Dean. of Colleges, GJUS&T, Hisar	Member
Dean, Academic Affair, GJUS&T, Hisar	Member
Director, Distance Education, Kurukshetra University	Member
Director, CDOE, GJUS&T, Hisar	Member
Director, HSB, GJUS&T, Hisar	Member
Chairman, Deptt. of CSE, GJUS&T, Hisar	Member
Chairman, Deptt. of Mass Communication, GJUS&T, Hisar	Member
Chairman, Deptt. of Mathematics, GJUS&T, Hisar	Member
Prof. H. Bansal, HSB, GJUS&T, Hisar	Member
Prof. Saroj, Deptt. of CSE, GJUS&T, Hisar	Member
Prof. Manoj Dayal, Deptt. Of Mass Communication, GJUS&T, Hisar	Member
Director, PDUCIC, GJUS&T, Hisar	Member
All Programme Co-ordinators, CDOE, GJUS&T, Hisar	Members

9.3 Centre for Internal Quality Assurance (CIQA)

The CIQA also oversees the development and preparation of SLMs, then it is submitted to the Board of Studies concerned for the approval. The objective of establishment of Centre for Internal Quality Assurance (CIQA) is to develop and put in place a comprehensive and dynamic internal quality assurance system to provide high quality programmes of higher education in the Open and Distance Learning mode.

Composition of CIQA for the year 2023-24

	CENTRE FOR INTERNAL QUALITY ASSURANCE (C.I.Q.A.)	
1	Vice Chancellor, GJUS&T	Chairperson
2	Registrar, GJUS&T	Member
3	Dean Academic Affairs	Member
4	Dean of Colleges, GJUS&T	Member
5	Controller of Examination, GJUS&T	Member
6	Prof. Sandeep Rana, (TA-HRM)	Member
7	Prof. O. P. Sangwan, Chairperson, Deptt. of CSE	Member
8	Prof. Vinod Bishnoi, Director, HSB	Member
9	Prof. M. R. Patra, Chairperson, Deptt. Of Mass Communication	Member
10	Director, DE, KUK	Member
11	Prof. R. Baskar, IGNOU, Delhi	Member
12	Director, DE, MDU	Member
13	Director, PDUCIC, GJUS&T	Member
14	Dy. Registrar (CDOE), GJUS&T	Member
15	DR/AR (Accounts), GJUS&T	Member
16	DR/AR (Academic), GJUS&T	Member
17	Director, Centre for Distance and Online Education/CIQA	Member Secretary

9.3 Functions of Centre for Internal Quality Assurance (CIQA)

Following are the main functions of CIQA:

- To maintain quality in the services provided to the learners.
- To ensure continuous improvement in the entire operations of the Higher Education Institution.
- To identify the key areas in which the Higher Education Institution should maintain quality.
- To disseminate information on quality assurance.
- To device mechanisms for interaction and obtaining feedback from various Departments or Centres or Schools in the Higher Education Institution.
- To suggest to the authorities of the Higher Education Institution, measures for qualitative improvement.

- To ensure the implementation of its recommendations through regular monitoring.
- To ensure participation of all stake holders namely, learners, teachers, staff, parents, society, employers and Government in Quality Improvement Process.
- To prepare Programme Project Report and ensure another launch of programme(s).
- Collection, collation and dissemination of accurate, complete and reliable statistics about the quality of the programme(s).

9.4 Activities of Centre for Internal Quality Assurance (CIQA)

Following are the main activities of CIQA:

- Prepare a Programme Project Report (PPR) for each programme according to the norms and guidelines prescribed by the Commission and wherever necessary by the appropriate regulatory authority having control over the programme;
- Get the Programme Project Report (PPR) approved by the appropriate authority of the Higher Educational Institution and the Commission before launch of the programme;
- Oversee the development of Study Learning Material (SLM), e-Content, e-tutorial, integration of Information and Communication Technology (ICT), setting up of Learning Centres and coordination with the parent institution and relevant Regulatory authorities;
- Put in place monitoring mechanism to ensure the proper implementation of Programme Project Reports (PPRs);
- Design annual plans for quality level enhancement at the level of the Higher Educational Institution and ensure their implementation;
- Arrange for feedback responses from students, employers and other stakeholders for quality related institutional processes;
- Develop quality benchmarks or parameters for the various academic and administrative activities of the Higher Educational Institution;
- Obtain information from other Higher Educational Institutions on various quality benchmarks or parameters and best practices;
- Organize workshops or seminars on quality related themes and Higher Educational Institution wise dissemination of the proceedings of such activities;
- Suggest restructuring of programmes in order to make them relevant to the job market;
- Develop and implement innovative practices in major areas leading to quality enhancement in services to the learners;
- Create learner centric environment rather than institution centric environment;
- Adopt measures to ensure internalisation and institutionalisation of quality enhancement practices through periodic accreditation and audit;

- Conduct or encourage system-based research to bring about qualitative change in the entire system;

- Coordinate between the Higher Educational Institution and the Commission for various quality related issues or guidelines;

- Record activities undertaken on quality assurance in the form of an annual report; and

- To coordinate recognition and accreditation of the Higher Educational Institution.

10. PROGRAMME OUTCOMES

The Diploma is a highly prestigious business-oriented programme of modern times, which prepares the students for taking up corporate and academic challenges in private and public sectors. The programme is aimed at following outcomes:

- **PO1.** Demonstrate a comprehensive understanding of the fundamental concepts and theories in data science, including statistics, machine learning, and data manipulation.

- **PO2.** Ability to collect, clean, preprocess, and analyze various types of data using appropriate tools and techniques.

- **PO3.** Proficiency in programming languages commonly used in data science such as Python or R, and the ability to develop scripts and algorithms for data analysis and visualization.

- **PO4.** Understand the principles of big data technologies and frameworks, and apply them to manage and analyze large-scale datasets.

- **PO5.** Apply data science techniques and methodologies to domains such as finance, healthcare, marketing, or social sciences, demonstrating practical knowledge and skills relevant to industry contexts.