JGI JAIN DEEMED-TO-BE UNIVERSITY

B.Sc (Honors) in Data Science and Analytics

Program Outcomes (POs)

Program Outcome	Description
PO1	Apply Scientific knowledge and understand fundamental scientific disciplines or their specialization to the solution of problems relevant society or to meet the developmental needs
PO2	Ability to assimilate scientific methodology in deriving conclusions and actions
PO3	Illustrate meaning of the world by connecting people, ideas, books, media and technology.
PO4	Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO5	Demonstrate empathetic social concern and equity centered national development
PO6	Recognize different value systems and understand the moral dimensions of decisions and accept responsibilities.
PO7	Understand the issues of environmental contexts and sustainable development.
PO8	Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes (PSOs)

Program Specific Outcome	Description
PSO1	Develop competence in the application of statistical techniques at a high level
PSO2	Provide practical skills of applied data science and business analytics
PSO3	Analyze data and text using quantitative and qualitative techniques
PSO4	Demonstrate an understanding on the concepts and principles related to their area of study and be able to communicate ideas and findings in a reliable and structured way.

Course Outcomes
2019-20 Batch

Semester	Subject Code	Subject	Course Outcomes
I	18BSDA1C02	DATABASE MANAGEMENT SYSTEM	**CO1**: Understanding the Architecture, Views and Data Independence with regards to Databases and Modelling Tiers. **CO2**: Understanding, implementing ER Models, Relationship Mapping based on 1:1, N:1, N: N Cardinalities and Functional Dependency. **CO3**: Conceptualizing, Enforcing Normalization based on Normal Forms to tackle consistency issues and Managing the File System based on Database context. **CO4**: Implementing, Coding and Employing Structured Query Language to enforce and accomplish several different tasks pertaining to a DBMS. **CO5**: Understanding and learning about Deadlocks, Starvation, their recovery, avoidance and preventive measures based on different protocols and rules.
	18BSDA1C03	APPLIED MATHEMATICS	**CO1**: Identify, Define the elements of a given Set and Apply basic set operations and notations. **CO2**: Understanding, implement and apply Matrix operations and methods to find solutions based on linear equations. **CO3**: Apply Derivative and Solve problems in a range of mathematical applications using Derivatives and Differential Calculus. **CO4**: Recognize and apply different techniques of Integration based on parts, trigonometry, partial fractions, etc. **CO5**: Learn to apply appropriate mathematical technique to determine the permutation or combination possible based on sets with unique, grouped and repeated elements.

Semester	Subject Code	Subject	Course Outcomes
	18BSDA1C05	ECONOMICS I	**CO1**: Develop the ability to know the importance of managerial economics and the roles and responsibility of a business economist **CO2**: illustrate the concept of demand, law of demand, price elasticity of demand and outline the concept of demand forecasting **CO3**: Develop the ability to know the concept of theory of consumption ,consumer surplus and its various approaches **CO4**: Outline the concept of theory of production ,supply and various types of cost. **CO5**: Epitomize the various market structure , their features and price determination under various situation
	18BSDA2C03	DESCRIPTIVE STATISTICS	**CO1**: Understanding and Implementing different concepts used to describe a data, its variables and types. **CO2**: Draw, Interpret and Compare different types of Graphs and Charts used in the domain of Descriptive Statistics. **CO3**: Analyze statistical data graphically using Frequency Distributions and Cumulative Frequency Distributions. **CO4**: Understand and apply appropriate techniques based on the data distribution to compare center (Mean, Median) and spread (IQR, SD). **CO5**: Employ the use of different application software such as Excel, SPSS and R to enforce statistical techniques and analyze data.
	20BSDA1C06	SPREADSHEET MODELLING	**CO1**: Understand and have exposure towards Spreadsheet software and its applications. **CO2**: Understanding and Creating Charts, Plots in MS Excel based on different types of Cell References. **CO3**: Implement and Deploy Data Validation Methods in Excel, Create and Analyze Pivot Tables and Charts. **CO4**: Understand and employ the use of Excel Add-Ins such as Goal Seek, What-if Analysis and Scenario Management. **CO5**: Learn about Data Protection and Security in Spreadsheet Software.

Semester	Subject Code	Subject	Course Outcomes
	18BSDA2C04	FINANCIAL STATEMENT ANALYSIS	**CO1**: Describe and explain the fundamental concepts underlying Accounting, Finance and Management. **CO2**: Understand the distinction and classify transactions into Capital or Revenue. **CO3**: Describe the main elements of Financial Accounting Information such as Assets, Liabilities, Revenue & Expense. **CO4**: Learn and Analyze the importance of Ratios in judging a company. Learn to relate quantitative data and financial statements to decode company status. **CO5**: Prepare and Analyze statement of Cash Flows by analyzing account and reporting the needed information to decision makers.
	18BSDAS51L	ICT FOR ANALYTICS (P)	**CO1**: Gain a Working Understanding with regards to several technical jargons associated with Internet and Communication Technologies. **CO2**: Understand, Apply and Implement several Data Collection, Data Preprocessing and Data Sanitization Techniques. **CO3**: Understand and Process the working of several different hardware employed in the domain of Data Collection and Analysis. **CO4**: Learn and Employ the use of MS Excel to perform Data Analysis based on features such as Functions, Plotting, Filtering. **CO5**: Learn and Use different tools which are necessary in the domain of Internet and Communication.
II	18BSDA3C01	PROBABILITY THEORY AND THEORETICAL DISTRIBUTION	**CO1**: Understand DBMS, Data Models, Data Views and build custom Entity Relationship Diagrams based on different problem sets. **CO2**: Understand and perform several tasks with regards to Data Analytics, Visualization, Data Manipulation using SAS programming. **CO3**: Employ and use Python programming to deploy analytical systems/programs. **CO4**: Learn R programming and understand its effectiveness with respect to Data Analytics. **CO5**: Understand and implement Data structures, Import statement, Packages and Inbuilt Functions in R Language.

Semester	Subject Code	Subject	Course Outcomes
	19BSDA3C02L	INTRODUCTION TO ANALYTICS	**CO1**: Understand DBMS, Data Models, Data Views and build custom Entity Relationship Diagrams based on different problem sets. **CO2**: Understand and perform several tasks with regards to Data Analytics, Visualization, Data Manipulation using SAS programming. **CO3**: Employ and use Python programming to deploy analytical systems/programs. **CO4**: Learn R programming and understand its effectiveness with respect to Data Analytics. **CO5**: Understand and implement Data structures, Import statement, Packages and Inbuilt Functions in R Language.
	19BSDA3C03	PROGRAMMING FOR ANALYTICS – R LANGUAGE	**CO1**: Install, Use, Code using R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames. **CO2**: Describe and Discuss the key terminology, concepts, tools and techniques used in Statistical Analysis. **CO3**: Define and Calculate the Probability that an event will occur. Understand and Implement Probability Distributions to solve problems involving them. **CO4**: Conduct and Interpret a variety of Hypothesis tests to aid Decision mak **CO5**: Understand, Analyze, Interpret Correlation, Use Simple/Multiple Regression Models to Analyze the underlying relationships between the variables.

Semester	Subject Code	Subject	Course Outcomes
	19MENVI0VE2	ENVIRONMENTAL STUDIES	**CO1**: Understanding of the basic concepts of environment and ecology to be aware of the surroundings at individual, local and global levels. **CO2**: Comprehending the usage of physical and biological resources available in nature; the issues that affect these resources and what one can do to sustain them. **CO3**: Understand and evaluate the global scale of environmental problems. **CO4**: Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions. **CO5**: Demonstrate an integrative approach to environmental issues with a focus on sustainability.
III	19BSDA3C01	SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE	**CO1**: Understand and implement the concepts of Sampling and Sampling Distributions. **CO2**: Understand and implement Hypothesis Testing, Level of Significance, Critical Region/Value with regards to a Sample. **CO3**: Understand and solve Statistical Tests based on Large Samples – Proportions Testing. **CO4**: Understand and solve Statistical Tests based on Small Samples – t-Test, Chi Square Test. **CO5**: Understand and implement Non-parametric Tests such as Mann-Whitney Test, Wilcoxon Test.

Semester	Subject Code	Subject	Course Outcomes
	19BSDA3C02	PROGRAMMING FOR ANALYTICS – PYTHON	**CO1**: Understand Python Programming, IDE Basics, Implement and Code Variables, Keywords, Input-Output Syntaxes for programming under Python. **CO2**: Understand and Apply different Operators available in Python Language alongside proper Operator Precedence and Associativity. **CO3**: Implement and Employ the use of different Data Structures, Decision Making Statements and Looping Constructs within Python Programming. **CO4**: Deploy and Formulate Reusability of Code within Python Environment using Functions, Modules and Packages. **CO5**: Understand the implications of Real-World Objects and Object-Oriented Programming, Exception Handling.
	19BSDA3S72	DATA VISUALIZATION	**CO1**: Understanding the importance of Data Visualization, Infographics and their utility in the domain of Analytics. **CO2**: Understanding, implementing charts, graphs and plots using R programming library ggplot2. **CO3**: Conceptualizing, incorporating and understanding the graph aesthetics, features, annotations and highlights. **CO4**: Employing the use of ggplot2 library to create advanced graphs and plots with simplicity and high information base. **CO5**: Understanding and learning Tableau software for Data visualization.

Semester	Subject Code	Subject	Course Outcomes
	19BSDA3C05	ECONOMICS II	**CO1**: Develop the ability to know various theories of economic approaches, concepts of national economy and methods of estimating national income **CO2**: Outline the concept of Public Finance, Public revenue and Deficit financing **CO3**: Develop the ability to know the concept and consequences of inflation and deflation in economy and also measures to control inflation and deflation **CO4**: Outline the concept of balance of payment, measures monetary and non-monetary measures and to be cognizant of business cycle. **CO5**: Epitomize the role external trade in economic development, foreign aid and outline the concept of exchange rate
		STATISTICAL TOOLS-SPSS	**CO1**: Understand the SPSS Environment, Tools, Menu Bar options and use them to work with different types of Data and Measures. **CO2**: Implement Data Creation, Transformation and application of Statistical Functions on the data imported within SPSS. **CO3**: Learn, deploy and analyze graphs in SPSS based on the imported dataset. **CO4**: Understand and incorporate Type Conversion based on SPSS functions and Partition the data. **CO5**: Apply various Data Mining techniques such as classification, Aggregation within SPSS.

Semester	Subject Code	Subject	Course Outcomes
		HR ANALYTICS	**CO1**: Understand and Relate with HR disciplines so as to implement Analytics within its domains and content. **CO2**: Implement Analytical Problem-Solving techniques and methods based on Business and its Structure. **CO3**: Employ and Implement Workforce Analytics within the Organization Structure, Strategize and Shape Organization Growth using in depth analysis of HR Policies and Succession Planning. **CO4**: Understand the implications of Acquiring High Quality Talent and use of proper Metrics and Quality Processes for their Development. **CO5**: Formulate and Devise plans for Talent Engagement, Retention and proper Compensation Policies.
	17REN4C01	RE IV	**CO1**:Name the different types of energy storage techniques with respect to different electrical components, storage materials and their characteristics. **CO2**:Identifying the types of battery systems in market and their development with respect to storage capacity. **CO3**:Demonstrate the concept of magnetic energy storage, super capacitors and hybridization of different energy producing - storage systems. **CO4**:Distinguish the different steps involved in battery recycling methods and different battery management technologies for the safe and harm free environment. **CO5**:Test the voltage of different types of batteries and assess the performance of the batteries. **CO6**:Design and implement a novel battery charger.

Semester	Subject Code	Subject	Course Outcomes
	16PHY4C01	PHYSICS-IV (ELEMENTS OF MODERN PHYSICS)	**CO1**:Interpretation of the inadequacies of classical mechanics and understanding of the historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter. **CO2**: Comprehending the central concepts of quantum mechanics and ability to identify and differentiate between wave functions, momentum and energy operator and the time dependent and independent Schrodinger equations. **CO3**:Apply problem solving skills to one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier **CO4**:Understanding the basics of Crystallography **CO5**:Ascertain the quantitative foundations of Atomic and Nuclear Physics **CO6**: Equipped with experimental foundations in Atomic physics, Nuclear physics and X-ray diffraction analysis
	16CS4C03	COMPUTER SCIENCE IV (OPERATING SYSTEM AND 4 UNIX)	**CO1**: Describe the evolution, types and fundamental components of a computer operating system **CO2**: Define, discuss, and explain the policies for CPU scheduling, deadlocks, memory management, and file systems. **CO3**: Implement processor scheduling, deadlocks and page replacement algorithms for a given scenario. **CO4**: Execute Linux basic commands and shell scripts. **CO5**: Create shell scripts to automate a sequence of operations. **CO6**: Discuss managing user accounts, disk space and security issues

Semester	Subject Code	Subject	Course Outcomes
	19MENVI0VE2	ABILITY ENHANCEMENT COURSE Environmental Science	**CO1** - Understanding the nature of our Environment and its importance in real Life **CO2** - To summarize the basic concepts of ecosystems and their functions **CO3** - To Classify the organisms based on the geographical areas, Ecological niche and Threats faced **CO4** - Explain the causes and outcomes of Environmental Pollution on this planet **CO5** - To create an awareness about the possible solutions to the environmental problems faced by mankind. **CO6** - To develop the right attitude towards the environment which eventually helps to deal with environmental problems
	17REN4C01L	RE LAB IV	**CO1**:Identify the different types of batteries and lab equipments **CO2**:Demonstrate the experiments to study the characteristics of the batteries and to determine the internal resistance of the batteries. **CO3**:Demonstrate the experiments to study the characteristics of the batteries in series and parallel. **CO4**:Demonstrate the experiments on charging and discharging of the energy storage devices. **CO5**:Use knowledge to select the right energy storage system for a particular application.
	16PHY4C1L	PHYSICS LAB-IV	**CO1**:Understand the working principles of instruments used in experiment **CO2**: Acquire the experimental skills in concepts like GM counter,Molecular spectroscopy, **CO3**:Analyze the results with observations and proper theory **CO4**:Gain knowledge about application of the experiments
	16CS4C3L	COMPUTER SCIENCE IV LAB	**CO1**: Explain the operators, and control structures that can be used to write shell programs. **CO2**: Design shell programs to interpret the concepts of operating system. **CO3**: Design shell programs that helps the functionalities of system administrators.

Semester	Subject Code	Subject	Course Outcomes
	16E**CO5**G01	ELEMENTS OF ENTREPRENEURSHIP General Elective-I	**CO1** :Outline the function of the entrepreneur in the successful, commercial application of innovations and recall the different opportunities and successful growth stories. **CO2** :Learn how to start an enterprise and design business plans that are suitable for funding by considering all dimensions of business. **CO3** :Prioritize personal attributes that enable best use of entrepreneurial opportunities **CO4** :Examine Economic conditions with higher level knowledge and understanding of contemporary trends in e-commerce and business finance. **CO5** :Explore entrepreneurial leadership and management style.
	16MNG5G02	HUMAN RESOURCE MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR General Elective-II	**CO1** :Demonstrate an understanding of key terms, theories/concepts and practices within the field of HRMSummarize the principles of volumetric analysis. **CO2** :Provide innovative solutions to problems in the fields of HRM and be able to identify and appreciate the significance of the ethical issues in HR **CO3** :Demonstrate competence in communicating and exchanging ideas in a group context **CO4** :Work effectively with colleagues with diverse skills, experience levels and way of thinking **CO5** :Evaluate HRM related social, cultural, ethical and environmental responsibilities and issues in a global context **CO6** :To integrate the knowledge of HR practices Related monetary benefits to avail within the organisation.

Semester	Subject Code	Subject	Course Outcomes
	20PHY5S01	COMPUTATIONAL PHYSICS Skill Elective-I	**CO1**: Understanding the basics of Python programming language. **CO2**:Analyze various numerical methods like Linear Regression, Successive bisection method, Gauss elimination method,, Gauss-Jordan elimination method, Matrix, Eigen value and Eigen vectors of matrices - Power and Jacobi method using python programming language. **CO3**:: Application of the Python programming language to process the Renewable energy data.
	20REN5C01	WIND ENERGY Skill Elective-II	**CO1**: Gives the fundamental knowledge and understanding about the wind flow across the globe and its types, the causes responsible for its production and the factors influencing it. **CO2**: Acquire the knowledge about the different factors influencing the wind energy conversion and also the idea on the design of wind energy conversion system. **CO3**: Evaluate the complete idea on the different methods of harnessing the wind energy and also the hybrid system implemented to increase the efficiency of energy production.
	16CS5S03	SOFTWARE ENGINEERING AND TESTING Skill Elective-III	**CO1**: Explain the different process models for a software project development. **CO2**: Discuss SRS, Design document, Project planning and scheduling **CO3**: Classifying test types and generating test cases using different techniques **CO4**: Discuss different techniques for cost estimation of software
	20PHY5S3L	COMPUTATIONAL PHYSICS LAB Skill Elective-I	**CO1**: Acquire the logical programming skills in Python to solve the problems in renewable energy data processing. **CO2**:Analyze the results with observations and proper theory **CO3**:Gain the knowledge about application of the Python programming language.
	20REN5C01L	WIND ENERGY LAB Skill Elective-II	**CO1**: Demonstrate the working of instruments in electronics and RE laboratory. **CO2**: Depict the working of a wind turbine coupled to a generator. **CO3**:Study of different parameters related to wind energy and their calibration.

Semester	Subject Code	Subject	Course Outcomes
	16CS5S3L	SOFTWARE ENGINEERING AND TESTING LAB	**CO1**: Discuss the different types of testing and develop test cases for boundary value analysis, equivalence class partitioning, path testing and explain with a suitable program. **CO2**: Develop test cases for automated unit testing, parameterized testing and perform tests using JUnit tool. **CO3**: Derive test cases for assertions and test using JUnit. **CO4**: Discuss load testing and perform real time load testing using Apache JMeter and find response time, delay time and throughput time. **CO5**: Analyse and translate software requirements specification into a design, and then realize that design using a suitable software engineering methodology.
	16ELE6D02	SOLAR ENERGY Discipline Elective-I	**CO1**: Understanding the solar basics and different instruments available in market to measure the availability of solar radiation **CO2**: Quantitative knowledge on solar cells and its conversion efficiency with respect to its characteristics. **CO3**: Executing and implementing the knowledge of solar basics to design, construct a solar panel for the conversion of solar energy to electricity. **CO4**: In depth knowledge on how a photovoltaic system is implemented on grid level, different design, their drawbacks like trouble shooting and so on related to it.
	16PHY6D102	MATERIALS SCIENCE Discipline Elective-II	**CO1**:Understanding of synthesis techniques, properties and applications of nano and smart materials **CO2**: Demonstrate good foundations in band theory of solids and free electron theory of metals. **CO3**: Ability to differentiate between the different types of magnetic materials and a good insight of dielectric materials. **CO4**: Equipped with good experimental skills in understanding the properties of different materials

Semester	Subject Code	Subject	Course Outcomes
	16CS6D304	RELATIONAL DATABASE MANAGEMENT SYSTEM Discipline Elective-III	**CO1**: Describe the fundamental elements of database management systems **CO2**: Explain the basic concepts of entity-relationship model **CO3**: Explain the basic concepts of relational data model, and relational algebra **CO4**: Design tables for a specific database and write SQL queries for data definition/ manipulation/ alteration **CO5**: Recognize and apply functional dependencies to improve database design (Normalization) CO6: Analyze the requirements of transaction processing, concurrency control
	18BSDA301	INFERENCE THEORY GENERAL ELECTIVE-I	**CO1**:Understand and Calculate Probabilities by applying Probability Laws and Theory. **CO2**:Identify appropriate Probability Distribution for a given discrete or continuous random variable. **CO3**: Application of Probability Theorems and Distributions concerning multiple random variables and compute probabilities. **CO4**: Understand and differentiate statistical methods to draw conclusions. **CO5**:Compute large sample, small sample tests and make inference about the phenomena.
	16ELE6D02L	SOLAR ENERGY LAB Discipline Elective-I	**CO1**: Demonstrate the working of instruments in electronics and RE laboratory. **CO2**: Depict the technique of performance of the solar cell. **CO3**: Measure the parameters of solar energy radiation. **CO4**: Evaluate the performance of the different solar radiation working systems.
	16PHY6D1L2	MATERIALS SCIENCE LAB Discipline Elective-II	**CO1**:Understand the working principles of instruments used in experiment **CO2**: Acquire the experimental skills in concepts like Energy band gap of materials, Permeability of materials, Fermi energy of materials and Dielectric constant of materials. **CO3**:Analyze the results with observations and proper theory **CO4**:Gain knowledge about application of the experiments

Semester	Subject Code	Subject	Course Outcomes
	16CS6D3L4	RELATIONAL DATABASE MANAGEMENT SYSTEM LAB Discipline Elective-III	**CO1**: Explain the data types, operators, and constraints in SQL and the general form of SQL commands **CO2**: Write SQL queries for data definition/manipulation/alteration **CO3**: Declare and enforce different constraints on a database **CO4**: Write SQL queries to get information from two tables using join operations **CO5**: Write SQL queries to create sub groups of tuples and apply aggregate functions to produce summary reports.
	16MATH6G4L1	INFERENCE THEORY – LAB GENERAL ELECTIVE-I	**CO1**: Describe the procedure to evaluate the mathematical expectation of discrete and continuous random variables. **CO2**: Examine the collected sample and assess different probability distributions. **CO3**: Test the collected sample (quantitative) and report the results based on small sample theory in statistics. **CO4**: Test the sample and report the results based on large sample theory in statistics. **CO5**: Test the sample and report the results based on non-parametric method (chi-square statistic) in statistics.