



DEVI AHILYA VISHWAVIDYALAYA, INDORE

School of Data Science and Forecasting

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Program outcome and course outcome



SCHOOL OF DATA SCIENCE AND FORECASTING

Program Outcomes (POs), Program Specific Outcomes (PSOs) and Course Outcomes (COs)

1.	Program Code	DS5A
	Program Title	M.B.A. (Business Analytics)

Program Outcomes (POs)		<ul style="list-style-type: none"> • Developing of managerial and analytical skills covering both technical and business domains. • Getting opportunities of higher studies in the area of Business Analytics. • Demonstrate use of team work, leadership skills, decision making and organization theory. • Apply Data Science techniques to the solution of real world business problems, communicate findings, and effectively present results.
Program Specific Outcomes (PSOs)		<ul style="list-style-type: none"> • Demonstrate knowledge of statistical data analysis techniques utilized in business decision making. • Employ cutting edge tools and technologies to analyze Big Data. • Understanding of the key technologies in business analytics: data mining, data visualization, forecasting methods, and statistics. • Use of Data Science technologies in finance and marketing analytics.
Course Outcomes (COs)	1.	<p>Course Code: DS5A-501</p> <p>Course Title: Principles of Management</p> <p>Course Outcomes: At the end of the course students will be able to-</p> <ul style="list-style-type: none"> • Define Management and explain how management differs according to level and whether a manager is a line manager or an enabling role. • Briefly describe and contrast four models of management; rational, goal, scientific, human relations, open systems • Describe and attain some elementary level of skills in the main management processes; planning, organizing, decision making and control.
	2.	<p>Course Code: DS5A-503</p> <p>Course Title: Database Management</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn the basics of database management. • The student will be able to design database using ER diagram. • The student will able to optimize database using normalization. • The student will able to work on database software MYSQL/Oracle. • The student will learn how to write SQL queries.
	3.	<p>Course Code: DS5A-505</p> <p>Course Title: Principles of Economics</p>

		<p>Course Outcomes: Upon completing the course, students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate knowledge of the laws of supply and demand and equilibrium; and apply the supply and demand model to analyze responses of markets to external events. • Evaluate economic issues and public policy by using economic models or data analysis while identifying underlying assumptions of the model(s) and limitations. • To generate and interpret summary statistics and regression models. • Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and break-even analysis.
	4.	<p>Course Code: DS5A-507 Course Title: Probability and Statistics Course Outcomes:</p> <ul style="list-style-type: none"> • Learn about data driven decision making under probabilistic framework. • Translate a business problem into a statistical inference problem. • Identify an appropriate statistical method to solve the problem. • Perform statistical analysis and draw conclusions from the analysis to solve the business problem.
	5.	<p>Course Code: DS5A-509 Course Title: Python for Analytics Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn core data types of python. • The student will learn conditional and looping operations in python. • The student will be able to work with Object-oriented concepts and Database connectivity in python. • The student will be able to analyze data using Pandas and Numpy. • The student will be able to visualize the data using seaborn and matplotlib.
	6.	<p>Course Code: DS5A-511 Course Title: Spreadsheet Modelling Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to perform basic operations in Excel. • The student will be able to summarize data using Grouping and pivot table. • The student will be able to write conditional statements and perform LOOKUP operations. • The student will be able to create charts in excel. • The student will be able to create a dashboard in excel.
	7.	<p>Course Code: DS5A-521</p>

		<p>Course Title: Fundamentals of Algorithms</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of algorithms. • The student will be able to work with the divide and conquer method. • The student will be able to work with Greedy methods. • The student will be able to work with backtracking algorithms. • The student will be able to understand NP-Hard and NP-Complete Problem.
	8.	<p>Course Code: DS5A-523</p> <p>Course Title: Decision Analysis</p> <p>Course Outcomes:</p> <p>After completing the course the student will -</p> <ul style="list-style-type: none"> • Learn basics of decision making and uncertainty analysis under a risky situation. • Understand concepts in Strategic Game Theory. • Learn how to model and solve real life cases using Game Theory.
	9.	<p>Course Code: DS5A-551</p> <p>Course Title: Business Communication</p> <p>Course Outcomes:</p> <p>At the end of the course the students will be able-</p> <ul style="list-style-type: none"> • To make business communication with the parties concerned. • To write memorandum, circulars, notices, business letters, and business reports. • To write resume and job application. • To participate in group discussion and interviews.
	10.	<p>Course Code: DS5A-502</p> <p>Course Title: Organizational Behaviour</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • At the end of the course students should be able to • Understand different aspects and components of individual behaviour. • Describe factors that are responsible to make an individual an effective manager.
	11.	<p>Course Code: DS5A-504</p> <p>Course Title: Operations Research</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understand the verbal description of the real system and accordingly identify and development of operational research models. • Understand the mathematical tools that are needed to solve optimization problems. • Use of mathematical software to solve the OR models developed. • Develop a technical report that describes the model, solving

		technique, results analysis and recommendations.
	12.	<p>Course Code: DS5A-506</p> <p>Course Title: Data Mining and Data Warehousing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basics of Data Warehouse. • The student will learn basics of Data Mining. • The student will be able to Pre process the data. • The student will be able to perform Market Basket analysis. • The student will be able to work with Classification Algorithms. • The student will be able to cluster the data.
	13.	<p>Course Code: DS5A-508</p> <p>Course Title: Business Mathematics</p> <p>Course Outcomes:</p> <p>After completion of the course the students will-</p> <ul style="list-style-type: none"> • Develop basic quantitative aptitude. • Learn basic concepts of mathematics required for further coursework. • Learn fundamental mathematics that is required for quantitative research in management discipline.
	14.	<p>Course Code: DS5A-510</p> <p>Course Title: Statistical Programming in R</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Data manipulation - acquiring skills in flexible matrix manipulation • Access online resources for R and import new function packages into the R workspace • Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets • Explore data-sets to create testable hypotheses and identify appropriate statistical tests • Perform appropriate statistical tests using R • Learn how to create high-quality figures, especially associated with more complex analyses (e.g. three dimensional scatter plots, animated chart Trellis displays, etc.).
	15.	<p>Course Code: DS5A-512</p> <p>Course Title: Machine Learning</p> <p>Course Outcomes:</p> <p>After completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • understand the basics of machine learning. • understand Regression analysis. • work on classification problems. • work with unsupervised learning approaches. • perform machine learning operations in scikit-learn.
	16.	<p>Course Code: DS5A-522</p> <p>Course Title: Marketing Management</p>

		<p>Course Outcomes: Students will be able</p> <ul style="list-style-type: none"> • To understand the key concept of marketing and its evolution • To develop an ability to access the dynamic marketing environment • To develop marketing strategy and evolving and matching marketing mix to consumer behaviour and perceptions of the product • To understand the segmentation, targeting and positioning process and its importance in light of changing marketing environment. • To develop the required skills to understand the effect of economic, political-legal, and cultural environments of a foreign country on company's international marketing decisions.
	17.	<p>Course Code: DS5A-524 Course Title: Financial Management Course Outcomes:</p> <ul style="list-style-type: none"> • The students will be able to understand the basic concepts of financial management and contemporary theory and policy in order to master the concepts, theories and technique of financial management, what represents the condition of profitable business operations and survival respectively development of business subjects and the economy as a whole. • Students should acquire the basic knowledge by means of combining theoretical cognitions and practical attitudes to enable them the understanding of financial problems in business practice after completed the vocational studies. • The students will also learn relevant, systematic, efficient and actual knowledge of financial management that can be applied in practice with making financial decisions and resolving financial problems.
	18.	<p>Course Code: DS5A-552 Course Title: Research Methodology Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the basic concept of research and data collection. • To be able to formulate research questions and develop a sufficiently coherent research design • To be able apply advanced knowledge in statistics to experimental and applied research • To be able to critically evaluate the methodological designs and select appropriate analytical strategies for their research projects. • To understand the interpretation and appropriate reporting requirements for research and thesis writing. • To be able to use statistical packages required quantitative analysis (e.g., R, SPSS and Excel).
	19.	<p>Course Code: DS5A-601</p>

		<p>Course Title: Forecasting Methods</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Discuss the key factors which affect the success of forecasting procedures. • Use Basic Statistical Techniques and statistical Graphics to forecast values. • Find different sets of Smoothed or Average values to be used when forecasting. • Understand the key concepts needed to use the Linear Regression model when forecasting. • Model and Forecast the Seasonal component of a set of values. • Model the different types of cyclical behaviour observed in different sets of values. • Understand and use the Box-Jenkins or ARMA Procedure.
	20.	<p>Course Code: DS5A-603</p> <p>Course Title: Econometrics</p> <p>Course Outcomes:</p> <p>Upon completing the course, students will be able to:</p> <ul style="list-style-type: none"> • Use various advanced econometric models, estimation methods and related econometric theories. • Application of appropriate econometric methods to test an economic theory including deriving and test a specific hypothesis relevant to a general economic or policy question. • Interpretation and critical evaluation of the outcomes of empirical analysis.
	21.	<p>Course Code: DS5A-605</p> <p>Course Title: Supply Chain Management</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Develop a sound understanding of the important role of supply chain management in today's business environment. • Become familiar with current supply chain management trends Understand and apply the current supply chain theories, practices and concepts utilizing case problems and problem-based learning situations. • Learn to use and apply computer-based supply chain optimization tools including the use of selected state of the art supply chain software suites currently used in business. • Develop and utilize critical management skills such as negotiating, working effectively within a diverse business environment, ethical decision making and use of information technology. • Demonstrate the use of effective written and oral communications, critical thinking, team building and presentation skills as applied to business problems. • Successfully complete a year-long team research or case project concluding with a written and oral presentation of the findings.
	22.	<p>Course Code: DS5A-607</p> <p>Course Title: Big Data Technologies</p>

		<p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand core concepts of Hadoop. • The student will know the HDFS and MapReduce. • The student will be able to work with Big Data tool such as Spark. • The student will be able to analyze big data sets. • The student will be able to create machine learning models for Big data.
	23.	<p>Course Code: DS5A-609</p> <p>Course Title: Data Visualization</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basic principles of data visualization. • The student will learn various types of charts to visualize data. • The student will understand Dashboard concepts. • The student will be able to use data visualization tools Tableau/Qlik view. • The student will be able to tell stories using the dashboard and visualization.
	24.	<p>Course Code: DS5A-621</p> <p>Course Title: Marketing Analytics</p> <p>Course Outcomes:</p> <p>This course will enhance the analytical skills of the student. He/ she will be able to perform research and gather data to help a company market its products or services after studying relevant data on consumer demographics, preferences, needs, and buying habits. Also, student will efficiently be able to:</p> <ul style="list-style-type: none"> • Monitor and forecast marketing and sales trends • Measure the effectiveness of marketing programs and strategies • Devise and evaluate methods for collecting data, such as surveys, questionnaires, and opinion polls • Gather data about consumers, competitors, and market conditions • Analyze data using statistical software • Convert complex data and findings into understandable tables, graphs, and written reports • Prepare reports and present results to clients and management.
	25.	<p>Course Code: DS5A-623</p> <p>Course Title: Financial Analytics</p> <p>Course Outcomes:</p> <p>After completing the course the students will be able</p> <ul style="list-style-type: none"> • To apply tools and techniques involved in financial analytics • To perform financial data analytics using R • To do the valuation of financial securities using R • To carry out derivative analytics and portfolio management using R
	26.	<p>Course Code: DS5A-651</p>

		<p>Course Title: Strategic Management</p> <p>Course Outcomes:</p> <p>After successful completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • understand the business's ability to establish its short, medium, and long-term plans in a highly dynamic industry. • developing and over sighting the business's corporate strategies in order to support growth objectives while strengthening the business core to develop and maintain a competitive advantage. • formulate the strategy, collaboration with both internal and external stakeholders and leading cross-functional teams in the development of business-wide operational strategies.
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2.	Program Code	DS5B
	Program Title	M.Sc. (Data Science and Analytics)

Program Outcomes (POs)	<ul style="list-style-type: none"> • Understanding of the key technologies in data science and analytics: data mining, data visualization techniques, machine learning, statistics, and NLP. • Getting knowledge on various theoretical and practical aspects of data science. • Demonstrate use of team work, leadership skills, and decision making. • Getting opportunities of higher studies in the area of data science.
Program Specific Outcomes (PSOs)	<ul style="list-style-type: none"> • Apply data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results. • Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy. • Demonstrate knowledge of statistical data analysis techniques utilized in business decision making. • Apply algorithms to build machine intelligence. • Work with messy data, applying models, and understanding the business context. • Work with unstructured data from various sources like video and social media. • Use Data Visualization techniques. • Write the programming codes in R and Python.
Course Outcomes (COs)	<p>1. Course Code: DS5B-501</p> <p>Course Title: Database Management</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn the basics of database management. • The student will be able to design database using ER diagram. • The student will able to optimize database using normalization. • The student will able to work on database software

		<p>MYSQL/Oracle.</p> <ul style="list-style-type: none"> • The student will learn how to write SQL queries.
	2.	<p>Course Code: DS5B-503</p> <p>Course Title: Forecasting Methods-I</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Discuss the key factors which affect the success of forecasting procedures. • Use Basic Statistical Techniques and statistical Graphics to forecast values. • Find different sets of Smoothed or Average values to be used when forecasting. • Understand the key concepts needed to use the Linear Regression model when forecasting. • Model and Forecast the Seasonal component of a set of values. • Model the different types of cyclical behaviour observed in different sets of values. • Understand and use the Box-Jenkins or ARMA Procedure.
	3.	<p>Course Code: DS5B-505</p> <p>Course Title: Operations Research</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understand the verbal description of the real system and accordingly identify and development of operational research models. • Understand the mathematical tools that are needed to solve optimization problems. • Use of mathematical software to solve the OR models developed. • Develop a technical report that describes the model, solving technique, results analysis and recommendations.
	4.	<p>Course Code: DS5B-507</p> <p>Course Title: Probability and Statistics</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Learn about data driven decision making under probabilistic framework. • Translate a business problem into a statistical inference problem. • Identify an appropriate statistical method to solve the problem. • Perform statistical analysis and draw conclusions from the analysis to solve the business problem.
	5.	<p>Course Code: DS5B-509</p> <p>Course Title: Python for Analytics</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn core data types of python. • The student will learn conditional and looping operations in python. • The student will be able to work with Object-oriented concepts and Database

		<ul style="list-style-type: none"> • connectivity in python. • The student will be able to analyze data using Pandas and Numpy. • The student will be able to visualize the data using seaborn and matplotlib.
	6.	<p>Course Code: DS5B-511</p> <p>Course Title: Advanced Excel</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to perform basic operations in Excel. • The student will be able to summarize data using Grouping and pivot table. • The student will be able to write conditional statements and perform LOOKUP operations. • The student will be able to create charts in Excel. • The student will be able to create a dashboard in Excel.
	7.	<p>Course Code: DS5B-521</p> <p>Course Title: Fundamentals of Algorithms</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of algorithms. • The student will be able to work with the divide and conquer method. • The student will be able to work with Greedy methods. • The student will be able to work with backtracking algorithms. • The student will be able to understand NP-Hard and NP-Complete Problem.
	8.	<p>Course Code: DS5B-523</p> <p>Course Title: Decision Analysis</p> <p>Course Outcomes:</p> <p>After completing the course the student will -</p> <ul style="list-style-type: none"> • Learn basics of decision making and uncertainty analysis under a risky situation. • Understand concepts in Strategic Game Theory. • Learn how to model and solve real life cases using Game Theory.
	9.	<p>Course Code: DS5B-551</p> <p>Course Title: Communication Skills</p> <p>Course Outcomes:</p> <p>At the end of the course the students will be able-</p> <ul style="list-style-type: none"> • To make communication with the parties concerned. • To write memorandum, circulars, notices, business letters, and business reports. • To write resume and job application. • To participate in group discussion and interviews.
	10.	<p>Course Code: DS5B-502</p> <p>Course Title: Data Mining and Data Warehousing</p> <p>Course Outcomes:</p>

		<ul style="list-style-type: none"> • The student will learn basics of Data Warehouse. • The student will learn basics of Data Mining. • The student will be able to Pre process the data. • The student will be able to perform Market Basket analysis. • The student will be able to work with Classification Algorithms. • The student will be able to cluster the data.
	11.	<p>Course Code: DS5B-504</p> <p>Course Title: Machine Learning</p> <p>Course Outcomes: After completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • understand the basics of machine learning. • understand Regression analysis. • work on classification problems. • work with unsupervised learning approaches. • perform machine learning operations in scikit-learn.
	12.	<p>Course Code: DS5B-506</p> <p>Course Title: Linear Algebra and Advanced Calculus</p> <p>Course Outcomes: After successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> • demonstrate competence with the basic ideas of linear algebra including concepts of vector spaces, linear systems, independence, theory of matrices, linear transformations, bases and dimension, eigenvalues, eigenvectors and diagonalization; • describe and apply the key concepts advance calculus; • communicate and understand mathematical statements, ideas and results, both verbally and in writing.
	13.	<p>Course Code: DS5B-508</p> <p>Course Title: Forecasting Methods-II</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understand the ways of forecasting in the new immerging field of technology. • Model and Forecast the different possible Trend, growth and seasonal components of a set of values • Use EViews to perform the key operations needed to obtain Descriptive Statistics and Regression Analysis. • To understand the different causing variables affecting forecast and model them. • Combine the Trend, Seasonal and Cyclical components to produce a more accurate forecast of a set of values.
	14.	<p>Course Code: DS5B-510</p> <p>Course Title: Big Data Technologies</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand core concepts of Hadoop. • The student will know the HDFS and MapReduce. • The student will be able to work with Big Data tool such as Spark.

		<ul style="list-style-type: none"> • The student will be able to analyze big data sets. • The student will be able to create machine learning models for Big data.
	15.	<p>Course Code: DS5B-522</p> <p>Course Title: Statistical Programming in R</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Data manipulation - acquiring skills in flexible matrix manipulation • Access online resources for R and import new function packages into the R workspace • Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets • Explore data-sets to create testable hypotheses and identify appropriate statistical tests • Perform appropriate statistical tests using R • Learn how to create high-quality figures, especially associated with more complex analyses (e.g. three dimensional scatter plots, animated chart Trellis displays, etc.).
	16.	<p>Course Code: DS5B-524</p> <p>Course Title: Scientific Computing</p> <p>Course Outcomes:</p> <p>After successful completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • transform scientific problems into generic computational models; • have an overview of advanced algorithms for solving a wide range of problems; • solve mathematical problems by using elementary algorithms, and compute solutions using a structured computer program. • display and analyse data appropriately, including the results of numerical calculations. • plan and develop efficient numerical programs.
	17.	<p>Course Code: DS5B-552</p> <p>Course Title: Technical Communication</p> <p>Course Outcomes:</p> <p>After completion of this course student will be able to-</p> <ul style="list-style-type: none"> • Document the knowledge about products, services, technology, or concepts into well-crafted and organised information collateral. • Write technical reports, memorandum, business letters, manuals, proposals, progress reports etc. • Develop document involving spatial description, description of mechanism, process, illustrations, etc.
	18.	<p>Course Code: DS5B-601</p>

		<p>Course Title: Cloud Computing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of Cloud Computing. • The student will be able to understand Cloud Computing Models. • The student will be able to work with AWS Cloud Platform. • The student will be able to manage cloud platform. • The student will be able to understand various cloud services.
	19.	<p>Course Code: DS5B-603</p> <p>Course Title: Data Visualization</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basic principles of data visualization. • The student will learn various types of charts to visualize data. • The student will understand Dashboard concepts. • The student will be able to use data visualization tools Tableau/Qlik view. • The student will be able to tell stories using the dashboard and visualization.
	20.	<p>Course Code: DS5B-605</p> <p>Course Title: Research Methodology</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the basic concept of research and data collection. • To be able to formulate research questions and develop a sufficiently coherent research design • To be able apply advanced knowledge in statistics to experimental and applied research • To be able to critically evaluate the methodological designs and select appropriate analytical strategies for their research projects. • To understand the interpretation and appropriate reporting requirements for research and thesis writing. • To be able to use statistical packages required quantitative analysis (e.g., R, SPSS and Excel).
	21.	<p>Course Code: DS5B-607</p> <p>Course Title: Nonlinear Optimization</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Students will learn the basic mechanisms that drive convergence of optimization algorithms. • Students will learn the basic theory that underpins the theory for each algorithm. • Students will learn to implement optimization algorithms. • Students will learn the scientific tools that are relevant for different classes of optimization problems and different

		<p>problem sizes.</p> <ul style="list-style-type: none"> Students will gain intuition into the strategies and techniques that drive the most successful methods.
	22.	<p>Course Code: DS5B-621</p> <p>Course Title: Cluster Analysis</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> The student will be able to understand basics of clustering. The student will be able to understand hierarchical clustering. The student will be able to understand advanced clustering approaches. The student will be able to assess the clustering performance. The student will be able to perform clustering operations in R/Python.
	23.	<p>Course Code: DS5B-623</p> <p>Course Title: Multivariate Analysis</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> To be able to understand the concept of analysing multivariate data. To be familiar with a basic minimum level of matrix competency and with general aspects of handling multivariate data. Perform exploratory analysis of multivariate data, such as plot multivariate data, calculating descriptive statistics, testing for multivariate normality; Conduct statistical inference about multivariate means including hypothesis testing, confidence ellipsoid calculation and different types of confidence intervals estimation; Undertake statistical analyses using appropriate multivariate techniques, which includes principal component, factor analysis, discriminate and clustering analysis Analyse multivariate data using the statistical software package.
	24.	<p>Course Code: DS5B-651</p> <p>Course Title: Numerical Methods</p> <p>Course Outcomes:</p> <p>After successful completion of the course the students will be able to-</p> <ul style="list-style-type: none"> Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems. Apply numerical methods to obtain approximate solutions to mathematical problems. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

		<ul style="list-style-type: none"> Analyse and evaluate the accuracy of common numerical methods.
	25.	<p>Course Code: DS5B-602</p> <p>Course Title: Deep Learning</p> <p>Course Outcomes: After completing the study of the course the students are expected to:</p> <ul style="list-style-type: none"> understand complexity of Deep Learning algorithms and their limitations; understand modern notions in data analysis oriented computing; be capable of confidently applying common Deep Learning algorithms in practice and implementing their own; be capable of performing distributed computations; be capable of performing experiments in Deep Learning using real-world data.
	26.	<p>Course Code: DS5B-604</p> <p>Course Title: Internet of Things</p> <p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> Understand the vision of IoT from a global context. Determine the Market perspective of IoT. Use of Devices, Gateways and Data Management in IoT. Building state of the art architecture in IoT. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
	27.	<p>Course Code: DS5B-606</p> <p>Course Title: Web Mining</p> <p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> understand basics of web mining. scrap the web content. analyzing web content. create NLP models to analyzing the web content. understand link analysis and page rank.
	28.	<p>Course Code: DS5B-622</p> <p>Course Title: Natural Language Processing</p> <p>Course Outcomes: After successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> Broad understanding of the field of Natural Language Processing. Understand mathematical concepts for NLP algorithms. Understanding the capabilities and limitations of NLP

		<p>technologies.</p> <ul style="list-style-type: none"> Apply the fundamental knowledge of various types of basic NLP techniques to analyze, design, formulate and implement solutions for any real time situation. Understand the theoretical concepts of NLP in formal language theory.
	29.	<p>Course Code: DS5B-624</p> <p>Course Title: Social Network Analysis</p> <p>Course Outcomes:</p> <p>After completion of this role student will be able to make strategies after:</p> <ul style="list-style-type: none"> Identifying those (individuals and groups) playing central roles (thought leaders, key knowledge brokers, information managers, etc). Identifying bottlenecks and those isolated. Spotting opportunities to improve knowledge flow. Targeting those where better knowledge sharing will have the most impact. Raising awareness of the significance of informal networks.

3.	Program Code	DS7A
	Program Title	M.Tech. (Data Science)

Program Outcomes (POs)	<ul style="list-style-type: none"> Understanding of the key technologies in data science such as database management, data mining, data visualization techniques, Machine Learning, Hadoop, R, forecasting methods, and statistics. Demonstrate knowledge of mathematical and statistical skills. Demonstrate use of team work, leadership skills, and decision making. Opportunities of higher studies in the area of Data Science. Knowledge on various theoretical and practical aspects of data science.
Program Specific Outcomes (PSOs)	<ul style="list-style-type: none"> Work with messy data, applying models, and understanding the business context. Work with unstructured data from various sources like video and social media. Use Data Visualization techniques. Write the programming codes in R and Python. Employ cutting edge tools and technologies to analyze Big Data.
Course Outcomes (COs)	<p>1.</p> <p>Course Code: DS7A-701</p> <p>Course Title: Operations Research</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the verbal description of the real system and accordingly identify and development of operational research

		<p>models.</p> <ul style="list-style-type: none"> • Understand the mathematical tools that are needed to solve optimization problems. • Use of mathematical software to solve the OR models developed. • Develop a technical report that describes the model, solving technique, results analysis and recommendations.
	2.	<p>Course Code: DS7A-703</p> <p>Course Title: Statistical Research Methods</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the basic concept of statistics and data collection. • To be able apply advanced knowledge in statistics to experimental and applied research • To be able to understand the concepts of validity and probability as they apply to different set of data. • To be able to critically evaluate the methodological designs and select appropriate analytical strategies for their research projects. • To understand the interpretation and appropriate reporting requirements for statistical and data analysis. • To be able to use statistical packages required quantitative analysis (e.g., R, SPSS and Excel).
	3.	<p>Course Code: DS7A-705</p> <p>Course Title: Data Visualization</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basic principles of data visualization. • The student will learn various types of charts to visualize data. • The student will understand Dashboard concepts. • The student will be able to use data visualization tools Tableau/Qlik view. • The student will be able to tell stories using the dashboard and visualization.
	4.	<p>Course Code: DS7A-707</p> <p>Course Title: RDBMS and NoSQL</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn the basics of database management. • The student will be able to design database using ER diagram. • The student will be able to optimize database using normalization. • The student will be able to work on database software MYSQL/Oracle. • The student will learn how to write SQL query. • The student will be able to understand NoSQL concepts.

	5.	<p>Course Code: DS7A-709</p> <p>Course Title: Python for Analytics</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn core data types of Python. • The student will learn conditional and looping operations in python. • The student will be able to work with Object-oriented concepts and Database connectivity in Python. • The student will be able to analyze data using Pandas and Numpy. • The student will be able to visualize the data using seaborn and matplotlib.
	6.	<p>Course Code: DS7A-711</p> <p>Course Title: Advanced Excel</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to perform basic operations in Excel. • The student will be able to summarize data using Grouping and pivot table. • The student will be able to write conditional statements and perform LOOKUP operations. • The student will be able to create charts in Excel. • The student will be able to create a dashboard in Excel.
	7.	<p>Course Code: DS7A-721</p> <p>Course Title: Cloud Computing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of Cloud Computing. • The student will be able to understand Cloud Computing Models. • The student will be able to work with AWS Cloud Platform. • The student will be able to manage cloud platform. • The student will be able to understand various cloud services.
	8.	<p>Course Code: DS7A-723</p> <p>Course Title: Statistical Programming in R</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Data manipulation - acquiring skills in flexible matrix manipulation • Access online resources for R and import new function packages into the R workspace • Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets • Explore data-sets to create testable hypotheses and identify appropriate statistical tests

		<ul style="list-style-type: none"> • Perform appropriate statistical tests using R • Learn how to create high-quality figures, especially associated with more complex analyses (e.g. three dimensional scatter plots, animated chart Trellis displays, etc.).
	9.	<p>Course Code: DS7A-725</p> <p>Course Title: Multivariate Analysis</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the concept of analysing multivariate data. • To be familiar with a basic minimum level of matrix competency and with general aspects of handling multivariate data. • Perform exploratory analysis of multivariate data, such as plot multivariate data, calculating descriptive statistics, testing for multivariate normality; • Conduct statistical inference about multivariate means including hypothesis testing, confidence ellipsoid calculation and different types of confidence intervals estimation; • Undertake statistical analyses using appropriate multivariate techniques, which includes principal component, factor analysis, discriminate and clustering analysis • Analyse multivariate data using the statistical software package.
	10.	<p>Course Code: DS7A-751</p> <p>Course Title: Fundamentals of Algorithms</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of algorithms. • The student will be able to work with the divide and conquer method. • The student will be able to work with Greedy methods. • The student will be able to work with backtracking algorithms. • The student will be able to understand NP-Hard and NP-Complete Problem.
	11.	<p>Course Code: DS7A-702</p> <p>Course Title: Forecasting Methods</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Discuss the key factors which affect the success of forecasting procedures. • Use Basic Statistical Techniques and statistical Graphics to forecast values. • Find different sets of Smoothed or Average values to be used when forecasting. • Understand the key concepts needed to use the Linear Regression model when forecasting. • Model and Forecast the Seasonal component of a set of values. • Model the different types of cyclical behaviour observed in different sets of values. • Understand and use the Box-Jenkins or ARMA Procedure.
	12.	<p>Course Code: DS7A-704</p>

		<p>Course Title: Big Data Technologies</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand core concepts of Hadoop. • The student will know the HDFS and MapReduce. • The student will be able to work with Big Data tool such as Spark. • The student will be able to analyze big data sets. • The student will be able to create machine learning models for Big data.
	13.	<p>Course Code: DS7A-706</p> <p>Course Title: Linear Algebra and Advanced Calculus</p> <p>Course Outcomes:</p> <p>After successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> • demonstrate competence with the basic ideas of linear algebra including concepts of vector spaces, linear systems, independence, theory of matrices, linear transformations, bases and dimension, eigenvalues, eigenvectors and diagonalization; • describe and apply the key concepts advance calculus; • communicate and understand mathematical statements, ideas and results, both verbally and in writing.
	14.	<p>Course Code: DS7A-708</p> <p>Course Title: Modelling and Simulation</p> <p>Course Outcomes:</p> <p>After completion of this course the students will be able to-</p> <ul style="list-style-type: none"> • model deterministic systems and differentiate between nonlinear and linear models. • numerically simulate linear and non-linear ordinary differential equations and deterministic systems. • estimate and validate a model based upon input and output data. • generate and test random number variates and apply them to develop simulation models • analyse output data produced by a model and test validity of the model.
	15.	<p>Course Code: DS7A-710</p> <p>Course Title: Machine Learning</p> <p>Course Outcomes:</p> <p>After completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • understand the basics of machine learning. • understand Regression analysis. • work on classification problems. • work with unsupervised learning approaches. • perform machine learning operations in scikit-learn.
	16.	<p>Course Code: DS7A-712</p> <p>Course Title: Data Mining and Data Warehousing</p>

		<p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basics of Data Warehouse. • The student will learn basics of Data Mining. • The student will be able to Pre process the data. • The student will be able to perform Market Basket analysis. • The student will be able to work with Classification Algorithms. • The student will be able to cluster the data.
	17.	<p>Course Code: DS7A-722</p> <p>Course Title: Scientific Computing</p> <p>Course Outcomes: After successful completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • transform scientific problems into generic computational models; • have an overview of advanced algorithms for solving a wide range of problems; • solve mathematical problems by using elementary algorithms, and compute solutions using a structured computer program. • display and analyse data appropriately, including the results of numerical calculations. • plan and develop efficient numerical programs.
	18.	<p>Course Code: DS7A-724</p> <p>Course Title: Natural Language Processing</p> <p>Course Outcomes: After successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • Broad understanding of the field of Natural Language Processing. • Understand mathematical concepts for NLP algorithms. • Understanding the capabilities and limitations of NLP technologies. • Apply the fundamental knowledge of various types of basic NLP techniques to analyze, design, formulate and implement solutions for any real time situation. • Understand the theoretical concepts of NLP in formal language theory.
	19.	<p>Course Code: DS7A-726</p> <p>Course Title: Web Mining</p> <p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • understand basics of web mining. • scrap the web content. • analyzing web content. • create NLP models to analyzing the web content. • understand link analysis and page rank.

	20.	<p>Course Code: DS7A-752</p> <p>Course Title: Technical Communication</p> <p>Course Outcomes: After completion of this course student will be able to-</p> <ul style="list-style-type: none"> • Document the knowledge about products, services, technology, or concepts into well-crafted and organised information collateral. • Write technical reports, memorandum, business letters, manuals, proposals, progress reports etc. • Develop document involving spatial description, description of mechanism, process, illustrations, etc.
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4.	Program Code	DS7B
	Program Title	M.Tech. (Big Data Analytics)

Program Outcomes (POs)	<ul style="list-style-type: none"> • Developing the analytical skills for dealing with Big data. • Opportunities of higher studies in the area of Big Data Science. • Knowledge on various theoretical and practical aspects of data science. • Demonstrate use of team work, leadership skills, and decision making.
Program Specific Outcomes (PSOs)	<ul style="list-style-type: none"> • Work with Big data using cutting edge tools and technologies to analyze Big Data. • Understanding of the key Big Data Technologies Hadoop, Spark, data mining, data visualization, machine learning. • Use Data Visualization techniques, machine learning and Deep learning. • Write the programming codes in R and Python.
Course Outcomes (COs)	<p>1.</p> <p>Course Code: DS7B-701</p> <p>Course Title: Statistical Computing</p> <p>Course Outcomes: Students will be able to:</p> <ul style="list-style-type: none"> • Implement statistical analysis techniques for solving practical problems. • Perform statistical analysis on variety of data. • Perform appropriate statistical tests and visualize the outcome.
	<p>2.</p> <p>Course Code: DS7B-703</p> <p>Course Title: Linear Algebra and Advanced Calculus</p> <p>Course Outcomes: After successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> • demonstrate competence with the basic ideas of linear algebra including concepts of vector spaces, linear systems, independence, theory of matrices, linear transformations, bases

		<p>and dimension, eigenvalues, eigenvectors and diagonalization;</p> <ul style="list-style-type: none"> describe and apply the key concepts advance calculus; communicate and understand mathematical statements, ideas and results, both verbally and in writing.
	3.	<p>Course Code: DS7B-705</p> <p>Course Title: Data Mining and Data Warehousing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> The student will learn basics of Data Warehouse. The student will learn basics of Data Mining. The student will be able to Pre process the data. The student will be able to perform Market Basket analysis. The student will be able to work with Classification Algorithms. The student will be able to cluster the data.
	4.	<p>Course Code: DS7B-707</p> <p>Course Title: Next Generation Databases</p> <p>Course Outcomes:</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Explore the relationship between Big Data and NoSQL databases Work with NoSQL databases to analyze the big data for useful business applications. Work with different data models to suit various data representation and storage needs.
	5.	<p>Course Code: DS7B-709</p> <p>Course Title: Python for Analytics</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> The student will learn core data types of python. The student will learn conditional and looping operations in python. The student will be able to work with Object-oriented concepts and Database connectivity in python. The student will be able to analyze data using Pandas and Numpy. The student will be able to visualize the data using seaborn and matplotlib.
	6.	<p>Course Code: DS7B-711</p> <p>Course Title: Advanced Excel</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> The student will be able to perform basic operations in Excel. The student will be able to summarize data using Grouping and pivot table. The student will be able to write conditional statements and perform LOOKUP operations. The student will be able to create charts in Excel. The student will be able to create a dashboard in Excel.

	7.	<p>Course Code: DS7B-721</p> <p>Course Title: Statistical Programming in R</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Data manipulation - acquiring skills in flexible matrix manipulation • Access online resources for R and import new function packages into the R workspace • Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets • Explore data-sets to create testable hypotheses and identify appropriate statistical tests • Perform appropriate statistical tests using R • Learn how to create high-quality figures, especially associated with more complex analyses (e.g. three dimensional scatter plots, animated chart Trellis displays, etc.).
	8.	<p>Course Code: DS7B-723</p> <p>Course Title: Multivariate Analysis</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the concept of analysing multivariate data. • To be familiar with a basic minimum level of matrix competency and with general aspects of handling multivariate data. • Perform exploratory analysis of multivariate data, such as plot multivariate data, calculating descriptive statistics, testing for multivariate normality; • Conduct statistical inference about multivariate means including hypothesis testing, confidence ellipsoid calculation and different types of confidence intervals estimation; • Undertake statistical analyses using appropriate multivariate techniques, which includes principal component, factor analysis, discriminate and clustering analysis • Analyse multivariate data using the statistical software package.
	9.	<p>Course Code: DS7B-751</p> <p>Course Title: Communication Skills</p> <p>Course Outcomes:</p> <p>At the end of the course the students will be able-</p> <ul style="list-style-type: none"> • To make communication with the parties concerned. • To write memorandum, circulars, notices, business letters, and business reports. • To write resume and job application. • To participate in group discussion and interviews.
	10.	<p>Course Code: DS7B-702</p> <p>Course Title: Forecasting Methods</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Discuss the key factors which affect the success of forecasting procedures.

		<ul style="list-style-type: none"> • Use Basic Statistical Techniques and statistical Graphics to forecast values. • Find different sets of Smoothed or Average values to be used when forecasting. • Understand the key concepts needed to use the Linear Regression model when forecasting. • Model and Forecast the Seasonal component of a set of values. • Model the different types of cyclical behaviour observed in different sets of values. • Understand and use the Box-Jenkins or ARMA Procedure.
	11.	<p>Course Code: DS7B-704</p> <p>Course Title: Big Data Technologies</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand core concepts of Hadoop. • The student will know the HDFS and MapReduce. • The student will be able to work with Big Data tool such as Spark. • The student will be able to analyze big data sets. • The student will be able to create machine learning models for Big data.
	12.	<p>Course Code: DS7B-706</p> <p>Course Title: Machine Learning</p> <p>Course Outcomes:</p> <p>After completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • understand the basics of machine learning. • understand Regression analysis. • work on classification problems. • work with unsupervised learning approaches. • perform machine learning operations in scikit-learn.
	13.	<p>Course Code: DS7B-708</p> <p>Course Title: Java Programming</p> <p>Course Outcomes:</p> <p>After successfully completing the course the students will be able to-</p> <ul style="list-style-type: none"> • work with core java concepts. • update and retrieve the data from the databases using JDBC-ODBC. • develop server side programs using Servlets. • develop Java Server Pages applications using JSP Tags.
	14.	<p>Course Code: DS7B-710</p> <p>Course Title: Data Visualization</p> <p>Course Outcomes:</p> <p>After completing the course the students will</p> <ul style="list-style-type: none"> • learn basic principles of data visualization. • learn various types of charts to visualize data.

		<ul style="list-style-type: none"> • understand Dashboard concepts. • be able to use data visualization tools Tableau/Qlik view. • be able to tell stories using the dashboard and visualization.
	15.	<p>Course Code: DS7B-712</p> <p>Course Title: Web Mining</p> <p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • understand basics of web mining. • scrap the web content. • analyzing web content. • create NLP models to analyzing the web content. • understand link analysis and page rank.
	16.	<p>Course Code: DS7B-722</p> <p>Course Title: Functional Programming</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Functional programming makes it easier to write parallel code for today's and tomorrow's multiprocessors by replacing mutable variables and loops with powerful ways to define and compose functions. • To provide a powerful paradigm in which to tackle complex, real-world programming tasks. • Able to understand the elements of the functional programming and learn how to apply them usefully in daily programming tasks.
	17.	<p>Course Code: DS7B-724</p> <p>Course Title: Natural Language Processing</p> <p>Course Outcomes: After successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • Broad understanding of the field of Natural Language Processing. • Understand mathematical concepts for NLP algorithms. • Understanding the capabilities and limitations of NLP technologies. • Apply the fundamental knowledge of various types of basic NLP techniques to analyze, design, formulate and implement solutions for any real time situation. • Understand the theoretical concepts of NLP in formal language theory.
	18.	<p>Course Code: DS7B-752</p> <p>Course Title: Technical Communication</p> <p>Course Outcomes: After completion of this course student will be able to-</p> <ul style="list-style-type: none"> • Document the knowledge about products, services, technology,

		<p>or concepts into well-crafted and organised information collateral.</p> <ul style="list-style-type: none"> • Write technical reports, memorandum, business letters, manuals, proposals, progress reports etc. • Develop document involving spatial description, description of mechanism, process, illustrations, etc.
	19.	<p>Course Code: DS7B-801 Course Title: Operations Research Course Outcomes:</p> <ul style="list-style-type: none"> • Understand the verbal description of the real system and accordingly identify and development of operational research models. • Understand the mathematical tools that are needed to solve optimization problems. • Use of mathematical software to solve the OR models developed. • Develop a technical report that describes the model, solving technique, results analysis and recommendations.
	20.	<p>Course Code: DS7B-803 Course Title: Algorithms for Data Analytics Course Outcomes: After completing the course the students will-</p> <ul style="list-style-type: none"> • Learn concepts and techniques and how to find useful knowledge. • Understand of the topics that can create an ideal analytic environment that is better suited to the challenges of today's analytics demands. • Harness the power of high performance computing architectures and data mining, text analytics, and machine learning algorithms.
	21.	<p>Course Code: DS7B-805 Course Title: Cloud Computing Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of Cloud Computing. • The student will be able to understand Cloud Computing Models. • The student will be able to work with AWS Cloud Platform. • The student will be able to manage cloud platform. • The student will be able to understand various cloud services.
	22.	<p>Course Code: DS7B-821 Course Title: Pattern Recognition Course Outcomes: After successfully completing the course the students will-</p>

		<ul style="list-style-type: none"> • learn the fundamentals of Pattern Recognition techniques • learn the various Statistical Pattern recognition techniques • learn the various Syntactical Pattern recognition techniques • learn the Neural Pattern recognition techniques.
	23.	<p>Course Code: DS7B-823</p> <p>Course Title: Predictive Analytics</p> <p>Course Outcomes: Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Understand how predictive analytics is used to forecast uncertain quantities and events. • Understand how to source, cleanse and manage data sets. • Use selected data analytics tools to manipulate and visualise data and also to develop predictive analytics models.
	24.	<p>Course Code: DS7B-825</p> <p>Course Title: Internet of Things</p> <p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Understand the vision of IoT from a global context. • Determine the Market perspective of IoT. • Use of Devices, Gateways and Data Management in IoT. • Building state of the art architecture in IoT. • Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
	25.	<p>Course Code: DS7B-827</p> <p>Course Title: Virtual Reality</p> <p>Course Outcomes: At the end of the course, students should able to</p> <ul style="list-style-type: none"> • Understand the basic concepts of Virtual Reality and its application areas. • Identify and setup the correct virtual environment as per the problem domain. • Understand the key features and objects in VR Environment. • Setup and Program the basic VR Applications.

5.	Program Code	DS7E
	Program Title	M.Tech. (Data Science) for Working Executives

Program Outcomes (POs)	<ul style="list-style-type: none"> • Training to the working executives in a flexible mode. • Knowledge on various theoretical and practical aspects of data
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	<p>science.</p> <ul style="list-style-type: none"> • Demonstrate knowledge of mathematical and statistical skills. • Demonstrate use of team work, leadership skills, and decision making. • Opportunities of higher studies in the area of Data Science.
Program Specific Outcomes (PSOs)	<ul style="list-style-type: none"> • Work with messy data, applying models, and understanding the business context. • Work with unstructured data from various sources like video and social media. • Understanding of the key technologies in data science such as database management, data mining, data visualization techniques, Machine Learning, Hadoop, R, forecasting methods, and statistics. • Use Data Visualization techniques. • Write the programming codes in R and Python. • Employ cutting edge tools and technologies to analyze Big Data.
Course Outcomes (COs)	<p>1.</p> <p>Course Code: DS7E-701 Course Title: RDBMS and NoSQL Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn the basics of database management. • The student will be able to design database using ER diagram. • The student will be able to optimize database using normalization. • The student will be able to work on database software MYSQL/Oracle. • The student will learn how to write SQL query. • The student will be able to understand NoSQL concepts.
	<p>2.</p> <p>Course Code: DS7E-703 Course Title: Statistical Research Methods Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the basic concept of statistics and data collection. • To be able apply advanced knowledge in statistics to experimental and applied research • To be able to understand the concepts of validity and probability as they apply to different set of data. • To be able to critically evaluate the methodological designs and select appropriate analytical strategies for their research projects. • To understand the interpretation and appropriate reporting requirements for statistical and data analysis. • To be able to use statistical packages required quantitative analysis (e.g., R, SPSS and Excel).

	3.	<p>Course Code: DS7E-705</p> <p>Course Title: Python for Analytics</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn core data types of Python. • The student will learn conditional and looping operations in python. • The student will be able to work with Object-oriented concepts and Database connectivity in Python. • The student will be able to analyze data using Pandas and Numpy. • The student will be able to visualize the data using seaborn and matplotlib.
	4.	<p>Course Code: DS7E-707</p> <p>Course Title: Advanced Excel</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to perform basic operations in Excel. • The student will be able to summarize data using Grouping and pivot table. • The student will be able to write conditional statements and perform LOOKUP operations. • The student will be able to create charts in Excel. • The student will be able to create a dashboard in Excel.
	5.	<p>Course Code: DS7E-721</p> <p>Course Title: Data Mining and Data Warehousing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basics of Data Warehouse. • The student will learn basics of Data Mining. • The student will be able to Pre process the data. • The student will be able to perform Market Basket analysis. • The student will be able to work with Classification Algorithms. • The student will be able to cluster the data.
	6.	<p>Course Code: DS7E-723</p> <p>Course Title: Multivariate Analysis</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the concept of analysing multivariate data. • To be familiar with a basic minimum level of matrix competency and with general aspects of handling multivariate data. • Perform exploratory analysis of multivariate data, such as plot multivariate data, calculating descriptive statistics, testing for multivariate normality; • Conduct statistical inference about multivariate means including hypothesis testing, confidence ellipsoid calculation and different types of confidence intervals estimation; • Undertake statistical analyses using appropriate multivariate techniques, which includes principal component, factor analysis,

		<p>discriminate and clustering analysis</p> <ul style="list-style-type: none"> Analyse multivariate data using the statistical software package.
	7.	<p>Course Code: DS7E-702</p> <p>Course Title: Operations Research</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the verbal description of the real system and accordingly identify and development of operational research models. Understand the mathematical tools that are needed to solve optimization problems. Use of mathematical software to solve the OR models developed. Develop a technical report that describes the model, solving technique, results analysis and recommendations.
	8.	<p>Course Code: DS7E-704</p> <p>Course Title: Statistical Programming in R</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> Data manipulation - acquiring skills in flexible matrix manipulation Access online resources for R and import new function packages into the R workspace Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets Explore data-sets to create testable hypotheses and identify appropriate statistical tests Perform appropriate statistical tests using R Learn how to create high-quality figures, especially associated with more complex analyses (e.g. three dimensional scatter plots, animated chart Trellis displays, etc.).
	9.	<p>Course Code: DS7E-706</p> <p>Course Title: Linear Algebra and Advanced Calculus</p> <p>Course Outcomes:</p> <p>After successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> demonstrate competence with the basic ideas of linear algebra including concepts of vector spaces, linear systems, independence, theory of matrices, linear transformations, bases and dimension, eigenvalues, eigenvectors and diagonalization; describe and apply the key concepts advance calculus; communicate and understand mathematical statements, ideas and results, both verbally and in writing.
	10.	<p>Course Code: DS7E-708</p> <p>Course Title: Machine Learning</p> <p>Course Outcomes:</p> <p>After completion of the course the students will be able to-</p> <ul style="list-style-type: none"> understand the basics of machine learning. understand Regression analysis.

		<ul style="list-style-type: none"> • work on classification problems. • work with unsupervised learning approaches. • perform machine learning operations in scikit-learn.
	11.	<p>Course Code: DS7E-722</p> <p>Course Title: Cloud Computing</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand the basics of Cloud Computing. • The student will be able to understand Cloud Computing Models. • The student will be able to work with AWS Cloud Platform. • The student will be able to manage cloud platform. • The student will be able to understand various cloud services.
	12.	<p>Course Code: DS7E-724</p> <p>Course Title: Web Mining</p> <p>Course Outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • understand basics of web mining. • scrap the web content. • analyzing web content. • create NLP models to analyzing the web content. • understand link analysis and page rank.
	13.	<p>Course Code: DS7E-801</p> <p>Course Title: Forecasting Methods</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Discuss the key factors which affect the success of forecasting procedures. • Use Basic Statistical Techniques and statistical Graphics to forecast values. • Find different sets of Smoothed or Average values to be used when forecasting. • Understand the key concepts needed to use the Linear Regression model when forecasting. • Model and Forecast the Seasonal component of a set of values. • Model the different types of cyclical behaviour observed in different sets of values. • Understand and use the Box-Jenkins or ARMA Procedure.
	14.	<p>Course Code: DS7E-803</p> <p>Course Title: Data Visualization</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will learn basic principles of data visualization. • The student will learn various types of charts to visualize data. • The student will understand Dashboard concepts. • The student will be able to use data visualization tools

		<p>Tableau/Qlik view.</p> <ul style="list-style-type: none"> The student will be able to tell stories using the dashboard and visualization.
	15.	<p>Course Code: DS7E-805</p> <p>Course Title: Decision Analysis</p> <p>Course Outcomes: After completing the course the student will -</p> <ul style="list-style-type: none"> Learn basics of decision making and uncertainty analysis under a risky situation. Understand concepts in Strategic Game Theory. Learn how to model and solve real life cases using Game Theory.
	16.	<p>Course Code: DS7E-807</p> <p>Course Title: Data Security</p> <p>Course Outcomes: On successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> define terms related to data and network security. describe the ways in which the security of data can be endangered. demonstrate competence in detecting potential security vulnerabilities, and demonstrate ways of recovering from the effects of attacks. analyse the offered system, and point to the potential safety problems. suggest the optimal way to organize data security system. choose an appropriate engineering approach to problem solving.
	17.	<p>Course Code: DS7E-821</p> <p>Course Title: Deep Learning</p> <p>Course Outcomes: After completing the study of the course the students are expected to:</p> <ul style="list-style-type: none"> understand complexity of Deep Learning algorithms and their limitations; understand modern notions in data analysis oriented computing; be capable of confidently applying common Deep Learning algorithms in practice and implementing their own; be capable of performing distributed computations; be capable of performing experiments in Deep Learning using real-world data.
	18.	<p>Course Code: DS7E-823</p> <p>Course Title: Technical Communication</p> <p>Course Outcomes:</p>

		<p>After completion of this course student will be able to-</p> <ul style="list-style-type: none"> • Document the knowledge about products, services, technology, or concepts into well-crafted and organised information collateral. • Write technical reports, memorandum, business letters, manuals, proposals, progress reports etc. • Develop document involving spatial description, description of mechanism, process, illustrations, etc.
	19.	<p>Course Code: DS7E-802</p> <p>Course Title: Modelling and Simulation</p> <p>Course Outcomes:</p> <p>After completion of this course the students will be able to-</p> <ul style="list-style-type: none"> • model deterministic systems and differentiate between nonlinear and linear models. • numerically simulate linear and non-linear ordinary differential equations and deterministic systems. • estimate and validate a model based upon input and output data. • generate and test random number variates and apply them to develop simulation models • analyse output data produced by a model and test validity of the model.
	20.	<p>Course Code: DS7E-804</p> <p>Course Title: Big Data Technologies</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • The student will be able to understand core concepts of Hadoop. • The student will know the HDFS and MapReduce. • The student will be able to work with Big Data tool such as Spark. • The student will be able to analyze big data sets. • The student will be able to create machine learning models for Big data.
	21.	<p>Course Code: DS7E-806</p> <p>Course Title: Scientific Computing</p> <p>Course Outcomes:</p> <p>After successful completion of the course the students will be able to-</p> <ul style="list-style-type: none"> • transform scientific problems into generic computational models; • have an overview of advanced algorithms for solving a wide range of problems; • solve mathematical problems by using elementary algorithms, and compute solutions using a structured computer program. • display and analyse data appropriately, including the

		<p>results of numerical calculations.</p> <ul style="list-style-type: none"> • plan and develop efficient numerical programs.
	22.	<p>Course Code: DS7E-808</p> <p>Course Title: Internet of Things</p> <p>Course Outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Understand the vision of IoT from a global context. • Determine the Market perspective of IoT. • Use of Devices, Gateways and Data Management in IoT. • Building state of the art architecture in IoT. • Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
	23.	<p>Course Code: DS7E-822</p> <p>Course Title: Natural Language Processing</p> <p>Course Outcomes:</p> <p>After successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • Broad understanding of the field of Natural Language Processing. • Understand mathematical concepts for NLP algorithms. • Understanding the capabilities and limitations of NLP technologies. • Apply the fundamental knowledge of various types of basic NLP techniques to analyze, design, formulate and implement solutions for any real time situation. • Understand the theoretical concepts of NLP in formal language theory.
	24.	<p>Course Code: DS7E-824</p> <p>Course Title: Social Network Analysis</p> <p>Course Outcomes:</p> <p>After completion of this role student will be able to make strategies after:</p> <ul style="list-style-type: none"> • Identifying those (individuals and groups) playing central roles (thought leaders, key knowledge brokers, information managers, etc). • Identifying bottlenecks and those isolated. • Spotting opportunities to improve knowledge flow. • Targeting those where better knowledge sharing will have the most impact. • Raising awareness of the significance of informal networks.

6.	Program Code	DS9Z
	Program Title	Ph.D. Data Science

Program Outcomes	<ul style="list-style-type: none"> • Developing research aptitude.
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(POs)	<ul style="list-style-type: none"> • Following the steps of research methodology. Learning the ways to data collection and analysis. • Writing of scientific reports, research papers and dissertation.
Program Specific Outcomes (PSOs)	<ul style="list-style-type: none"> • Problem understanding and developing the solution methods. • Data collection and analysis. • Use Data Visualization techniques. • Employ cutting edge tools and technologies of Data Science. • Demonstrate knowledge of mathematical and statistical skills.
Course Outcomes (COs)	<p>1.</p> <p>Course Code: DS7Z-901</p> <p>Course Title: Research Methodology</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • To be able to understand the basic concept of research and data collection. • To be able to formulate research questions and develop a sufficiently coherent research design • To be able apply advanced knowledge in statistics to experimental and applied research. Development of hypothesis and testing. • To be able to critically evaluate the methodological designs and select appropriate analytical strategies for their research projects. • To understand the interpretation and appropriate reporting requirements for research and thesis writing. • To be able to use statistical packages required quantitative analysis (e.g., R, SPSS and Excel).
	<p>2.</p> <p>Course Code: DS7Z-902</p> <p>Course Title: Review of Published Research</p> <p>Course Outcomes:</p> <p>At the end of the course the student will learn to</p> <ul style="list-style-type: none"> • do literature survey for research. • synthesize the results and writing the review.
	<p>3.</p> <p>Course Code: DS7Z-903</p> <p>Course Title: Computer Applications</p> <p>Course Outcomes:</p> <p>At the end of the course the students will be able to-</p> <ul style="list-style-type: none"> • Apply computer resources for use in academics. • Construct academic documents using Microsoft Word. • Create spreadsheets with formulas and graphs using Microsoft Excel. • Develop presentations containing animation and graphics using Microsoft PowerPoint. • Conduct data analysis with SPSS, MATLAB.
	<p>4.</p> <p>Course Code: DS7Z-904</p> <p>Course Title: Predictive Analytics</p>

		<p>Course Outcomes: Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none">• Understand how predictive analytics is used to forecast uncertain quantities and events.• Understand how to source, cleanse and manage data sets.• Use selected data analytics tools to manipulate and visualise data and also to develop predictive analytics models.
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