ADVANCED CERTIFICATE IN DATA SCIENCE

Course Overview

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1. Course Overview

Headings	Details
Course Code	ACDS
Product Title (Internal)	Advanced Certificate in Data Science
Course Title (External)	Advanced Certificate in Data Science (E-Learning)
Learning Mode	Full-time/ Part-time
Delivery Mode	Synchronous & Asynchronous E-learning
Target Persona	Professionals aiming to develop future-ready digital skills and advance their careers in data science and data analytics.
Entry-Prerequisites	• Academic: Minimum one credit in O Level or its equivalent • English Proficiency – Minimum IELTS 5.5 or its equivalent • Age – Minimum 21 years • Work Experience – Not Mandatory
SSG Course Reference No	TGS-2022014371
Course Validity Date	31 Jan 2025
Course Developer	Lithan Academy
Relevant Job roles after completion of the course	Junior Data Scientist Associate Data Analyst

2. Course Brief

The "Advanced Certificate in Data Science" course is designed to provide learners with a comprehensive understanding of data science principles and techniques. Upon completion of this course, learners will have excellent job prospects and a wide range of job roles to choose from, including Data Analysts, Data Scientists, Machine Learning Engineers, and Data Consultants. With the increasing demand for data-driven decision-making in various industries, this course equips learners with the skills and knowledge required to excel in the field of Data Science.

The course is structured into four comprehensive modules, each focusing on essential aspects of Data Science. Module 1, "Data Analytics & Visualization," introduces learners to Python programming, covering topics such as functions, conditionals, file handling, and data manipulation with Pandas and Numpy. They also learn about data visualization using Matplotlib. This module provides a solid foundation in data analytics and visualization, enabling learners to extract insights from data and effectively present their findings.

In Module 2, "Data Science Essentials," learners delve into key concepts such as data validation and transformation, data transfer and modelling, and data integration on Microsoft Azure. They also gain knowledge of deploying and managing data science models on Microsoft Azure. This module equips learners with essential skills for handling real-world data science projects and utilizing cloud-based tools for data analysis.

Module 3, "Principles of Machine Learning," focuses on machine learning techniques. Learners explore classification and regression methods, learn how to improve machine learning models, and gain insights into tree and ensemble methods, as well as optimization-based methods. This module empowers learners to build robust machine learning models and optimize their performance.

The final module, "Capstone Project-Data Analytics," offers learners the opportunity to apply their knowledge and skills to a real-world data analytics project. They learn project proposal and planning, data acquisition and preparation, exploratory data analysis, data analytics and modelling, results evaluation, and interpretation, as well as presentation and documentation. Through this capstone project, learners showcase their ability to solve complex data problems and effectively communicate their findings and recommendations.

Throughout the course, learners develop a strong foundation in Python programming, data analytics, visualization, and machine learning. They also gain hands-on experience with data manipulation, cloud-based data integration, and project management. By combining theoretical knowledge with practical skills, this course prepares learners to meet the demands of the data-driven industry.

In summary, the "Advanced Certificate in Data Science" course provides learners with comprehensive training in Data Science principles and techniques. With a focus on practical skills and real-world applications, this course prepares learners for various job roles in the field of data science. Upon completion, learners can expect to have excellent job prospects and be well-prepared to contribute to data-driven decision-making processes in organizations.

3. Course KSA Summary

Knowledge Statements:

- Analyze and interpret real-world datasets using appropriate data analytics techniques and tools.
- Explain the key concepts, methodologies, and best practices in Data Science.
- Identify and apply various supervised and unsupervised machine learning algorithms for different data-driven tasks.
- Demonstrate proficiency in data preprocessing, feature selection, and model evaluation in Data Science.
- Describe the process of developing a data-driven solution through a capstone project.

Skills Statements:

- Utilize data visualization techniques to present complex information in a clear and concise manner.
- Apply data cleaning techniques to ensure data quality and accuracy in data analytics projects.
- Employ different machine learning algorithms to solve real-world problems.
- Evaluate and select appropriate machine learning models based on their performance and suitability.
- Collaborate effectively in teams to develop and implement data-driven solutions for a capstone project.

Ability Statement:

Extract insights from complex datasets, create informative visualizations, and develop effective machine learning models to drive data-informed decision-making.

4. Course Summary

4.1 Module-Session Details

Sl No	Module Names	Module Code	Learning Activity					
			E-Learning (Async)	Flipped Class (Sync)	Mentoring Support (Sync)	Mentoring Support (Async)	Assessment (Sync)	Total Hours
1	WSQ Data Analytics & Visualization (SF)	ACDS-DAV	12	12	24	12	0.5	60.5
2	WSQ Data science essentials (SF)	ACDS-DSE	12	12	24	12	0.5	60.5
3	WSQ Principles of machine learning (SF)	ACDS-PML	12	12	24	12	0.5	60.5
4	WSQ Capstone Project-data analytics (SF)	ACDS-DSC	-	-	36	24	0.5	60.5
	TOTAL		**36**	**36**	**108**	**60**	**2**	**242**

4.2 Learning Mode & Duration

Learning Mode	Course Duration	Guided Learning Hours	Hours/Week	days/Week	Hours/Day
Full-time	3 months	240 hours	20 hours/week	2.5 days/week	8 hours/day
Part-time	6 months	240 hours	9 hours/week	3 days/week	3 hours/day

5. Module Details – Data Analytics & Visualization

5.1 Module Brief

The "Data Analytics & Visualization" module equips learners with the necessary knowledge and skills to perform data analysis and visualization tasks using Python. Through a series of learning units (IU), learners will acquire proficiency in various key areas.

In the initial learning units, learners will gain an introduction to Python programming, including essential concepts such as functions, conditionals, and file handling. This foundational knowledge will provide learners with the necessary programming skills to work with data effectively.

The module also covers data manipulation using Pandas, a powerful data manipulation library in Python. Learners will learn how to load, clean, and transform data using Pandas, enabling them to perform various data wrangling tasks efficiently.

In addition, learners will explore the functionalities of NumPy, a fundamental library for numerical computing in Python. They will acquire skills in array manipulation, mathematical operations, and statistical analysis using NumPy.

The module culminates with a focus on data visualization using Matplotlib. Learners will learn how to create visually appealing and informative plots, charts, and graphs to effectively communicate insights derived from data analysis.

Through the module's projects, learners will have the opportunity to apply their acquired knowledge and skills in a real-world context. They will develop a Python project centred around analysing and visualizing sales data using Pandas and Matplotlib. This project will allow learners to practice data manipulation techniques, extract meaningful insights from the data, and present their findings through compelling visualizations.

By the end of the module, learners will have gained proficiency in Python programming, data manipulation with Pandas, numerical computing with NumPy, and data visualization with Matplotlib. They will be able to perform data analysis tasks, apply statistical techniques, and effectively communicate their findings through visualizations. These skills will empower learners to make data-driven decisions and present insights in a clear and concise manner in various professional settings.

Instructional Units:
1. Introduction to Python programming,
2. Functions, Conditionals, File Handling, Functions,
3. Data Manipulation with Pandas,
4. Numpy,
5. Visualization with Matplotlib

Module Project:

Project Objective: Develop a Python project for analyzing and visualizing sales data using Pandas and Matplotlib.

Project Tasks

1. Task 1: Load the sales data from a CSV file into a Pandas DataFrame.
2. Task 2: Perform data cleaning and manipulation tasks.
3. Task 3: Use conditional statements to filter the data based on specific criteria.
4. Task 4: Calculate various statistics and metrics from the data.
5. Task 5: Create visualizations to represent the sales data and highlight trends or patterns.

5.2 Module Session Plan

Session No#	Session Type	Day no#	Duration Hrs
1	E-Learning on IU 1& 2	1	3
2	Flipped Class on IU 1 & 2	1	3
3	Mentoring Support - Assignment on IU 1& 2	2	3
4	E-Learning on IU 3	3	3
5	Flipped Class on IU 3	3	3
6	Mentoring Support - Assignment on IU 3	4	3
7	E-Learning on IU 4	5	3
8	Flipped Class on IU 4	5	3
9	Mentoring Support - Assignment on IU 4	6	3
10	E-Learning on IU 5	7	3
11	Flipped Class on IU 5	7	3
12	Mentoring Support - Assignment on IU 5	8	3
13	Mentoring Support – Project Planning -1	9	3
14	Mentoring Support – Projects Implementation 1	9	3
15	Mentoring Support – Project Planning -2	10	3
16	Mentoring Support – Projects Implementation 2	11	3
17	Mentoring Support – Project Planning -3	12	3
18	Mentoring Support – Projects Implementation 3	13	3
19	Mentoring Support – Project Planning -4	14	3
20	Mentoring Support – Projects Implementation 4	15	3
21	Summative Assessment (per learner)	16	30 min

Module Name	E-Learning Async	Flipped Class Sync	Assignment Sync	Project Planning Sync	Project Implementation Async
Data Analytics & Visualization	12	12	12	12	12

6. Module Details – Data Science Essentials

6.1 Module Brief

The "Data Science Essentials" module is designed to provide learners with a solid foundation in essential knowledge and skills required in the field of data science. Through a comprehensive set of Instructional Units (IU), learners will acquire the necessary expertise to excel in various aspects of data science.

In IU 1, learners will be introduced to the fundamentals of data science. They will gain an understanding of key concepts, methodologies, and the role of data science in decision-making processes. This IU sets the stage for learners to explore the exciting field of data science.

IU 2 focuses on data validation and transformation. Learners will learn techniques to assess the quality and integrity of data, identify errors or inconsistencies, and implement appropriate validation processes. They will also acquire skills in transforming data to ensure its suitability for analysis.

The IU 3 delves into data transfer and modelling. Learners will explore different methods and tools for transferring data between systems or platforms. They will also acquire knowledge of data modelling techniques to organize and structure data in a way that supports analysis and decision-making.

IU 4 introduces learners to data integration using Microsoft Azure. They will gain hands-on experience in leveraging Azure services to seamlessly integrate data from various sources, ensuring a unified view for analysis. This IU equips learners with the skills to harness the power of cloud computing in data integration.

Finally, IU 5 focuses on the deployment and management of data science models on Microsoft Azure. Learners will gain insights into the process of deploying models into production environments and managing their lifecycle. They will also learn best practices for monitoring, updating, and maintaining data science models.

Throughout the module, learners will engage in a practical project that encapsulates the key learnings. They will develop a data science project that involves validating, transferring, integrating, and deploying models using Microsoft Azure. By working on this project, learners will apply their knowledge and skills in a real-world scenario, gaining hands-on experience and solidifying their understanding of data science essentials.

In summary, the "Data Science Essentials" module equips learners with the knowledge and skills necessary to excel in the field of data science. From data validation and transformation to data integration and model deployment on Microsoft Azure, learners will develop a comprehensive understanding of essential data science concepts and practices. By completing the project, learners will demonstrate their ability to apply these skills to real-world scenarios, preparing them for success in data-driven industries.

Instructional Units:

1. Introduction to Data Science
2. Data validation and transformation
3. Data transfer and modelling
4. Data Integration on Microsoft Azure
5. Deployment and Management of Data Science Models on Microsoft Azure

Module Project:

Project Objective: Develop a data science project to validate, transfer, integrate, and deploy models using Microsoft Azure.

Project Task:

1. Explore various data validation techniques and implement them on a given dataset.
2. Transform the data by applying preprocessing steps.
3. Transfer the data between different sources ensuring its integrity and consistency.
4. Model the data using appropriate machine learning algorithms.
5. Deploy Azure models for real-time prediction and analysis.

6.2 Module Session Plan

Session No#	Session Type	Day no#	Duration Hrs
1	E-Learning on IU 1& 2	1	3
2	Flipped Class on IU 1 & 2	1	3
3	Mentoring Support - Assignment on IU 1& 2	2	3
4	E-Learning on IU 3	3	3
5	Flipped Class on IU 3	3	3
6	Mentoring Support - Assignment on IU 3	4	3
7	E-Learning on IU 4	5	3
8	Flipped Class on IU 4	5	3
9	Mentoring Support - Assignment on IU 4	6	3
10	E-Learning on IU 5	7	3
11	Flipped Class on IU 5	7	3
12	Mentoring Support - Assignment on IU 5	8	3
13	Mentoring Support – Project Planning -1	9	3
14	Mentoring Support – Projects Implementation 1	9	3
15	Mentoring Support – Project Planning -2	10	3
16	Mentoring Support – Projects Implementation 2	11	3
17	Mentoring Support – Project Planning -3	12	3
18	Mentoring Support – Projects Implementation 3	13	3
19	Mentoring Support – Project Planning -4	14	3
20	Mentoring Support – Projects Implementation 4	15	3
21	Summative Assessment (per learner)	16	30 min

Module Name	E-Learning Async	Flipped Class Sync	Assignment Sync	Project Planning Sync	Project Implementation Async
Data Science Essentials	12	12	12	12	12

7. Module Details – Principles of machine learning

7.1 Module Brief

The "Principles of Machine Learning" module equips learners with the essential knowledge and skills required to understand and apply machine learning techniques. Through a comprehensive set of Instructional Units (IU), learners will acquire a strong foundation in the principles and methodologies of machine learning.

In IU 1, learners will be introduced to classification, a fundamental concept in machine learning. They will explore various algorithms and techniques to classify data into different categories, enabling them to make predictions or decisions based on input features.

IU 2 focuses on regression, another key aspect of machine learning. Learners will learn how to build models that can predict continuous numeric values. They will gain insights into different regression algorithms and understand how to evaluate and interpret their performance.

IU 3 delves into improving machine learning models. Learners will explore techniques to enhance model performance, such as feature selection, dimensionality reduction, and model evaluation metrics. They will learn how to fine-tune models and optimize their hyperparameters for better accuracy and generalization.

In IU 4, learners will delve into tree and ensemble methods. They will gain an understanding of decision trees, random forests, and other ensemble techniques that leverage the power of combining multiple models to achieve better predictive performance.

IU 5 introduces learners to optimization-based methods. They will explore optimization algorithms such as gradient descent and genetic algorithms, enabling them to optimize model parameters for improved performance.

Throughout the module, learners will apply their knowledge and skills through a practical project. They will develop a data science project that involves validating, transferring, integrating, and deploying models using Microsoft Azure. This project will allow learners to apply the principles of machine learning in a real-world scenario, enhancing their understanding and practical abilities.

By completing this module, learners will gain a comprehensive understanding of the principles of machine learning. They will acquire the skills necessary to implement various machine learning techniques, optimize models, and deploy them using Microsoft Azure. The combination of theoretical knowledge and hands-on experience gained in this module will empower learners to apply machine learning in a wide range of domains and contribute to data-driven decision-making processes.

Instructional Units:

1. Introduction to Data Science
2. Data validation and transformation
3. Data transfer and modelling
4. Data Integration on Microsoft Azure
5. Deployment and Management of Data Science Models on Microsoft Azure

Module Project:

Project Objective: Develop a data science project to validate, transfer, integrate, and deploy models using Microsoft Azure.

Project Task:

1. Implement a classification algorithm to predict customer churn.
2. Develop a regression model to estimate housing prices based on features.
3. Improve the performance of machine learning models by optimizing hyperparameters.
4. Utilize tree-based methods to analyze and interpret feature importance in a dataset.
5. Apply optimization-based methods for better performance and accuracy.

7.2 Module Session Plan

Session No#	Session Type	Day no#	Duration Hrs
1	E-Learning on IU 1& 2	1	3
2	Flipped Class on IU 1 & 2	1	3
3	Mentoring Support - Assignment on IU 1& 2	2	3
4	E-Learning on IU 3	3	3
5	Flipped Class on IU 3	3	3
6	Mentoring Support - Assignment on IU 3	4	3
7	E-Learning on IU 4	5	3
8	Flipped Class on IU 4	5	3
9	Mentoring Support - Assignment on IU 4	6	3
10	E-Learning on IU 5	7	3
11	Flipped Class on IU 5	7	3
12	Mentoring Support - Assignment on IU 5	8	3
13	Mentoring Support – Project Planning -1	9	3
14	Mentoring Support – Projects Implementation 1	9	3
15	Mentoring Support – Project Planning -2	10	3
16	Mentoring Support – Projects Implementation 2	11	3
17	Mentoring Support – Project Planning -3	12	3
18	Mentoring Support – Projects Implementation 3	13	3
19	Mentoring Support – Project Planning -4	14	3
20	Mentoring Support – Projects Implementation 4	15	3
21	Summative Assessment (per learner)	16	30 min

Module Name	E-Learning Async	Flipped Class Sync	Assignment Sync	Project Planning Sync	Project Implementation Async
Principles of machine learning	12	12	12	12	12

8. Module Details – Capstone Project – Data Analytics

8.1 Module Brief

The "Capstone Project-Data Analytics" module serves as the culminating experience for learners in the data science program, allowing them to apply their knowledge and skills to a real-world data analytics project. Through a series of Instructional Units (IU), learners will acquire the necessary expertise in various stages of the data analytics process.

In the first IU, learners will gain proficiency in project proposal and planning. They will learn how to define project objectives, outline the scope of work, and develop a comprehensive plan to guide the entire project.

IU 2 focuses on data acquisition and preparation. Learners will explore various techniques for acquiring data from different sources, perform data cleaning and preprocessing tasks, and ensure data quality and consistency.

IU 3 covers exploratory data analysis, where learners will employ visualization and statistical techniques to gain insights, identify patterns, and uncover relationships within the dataset.

In IU 4, learners will delve into data analytics and modelling. They will apply advanced analytics techniques, such as machine learning algorithms and predictive modelling, to extract meaningful information and make data-driven decisions.

IU 5 emphasizes results evaluation and interpretation. Learners will learn how to evaluate the effectiveness of their data analytics models, interpret the results, and draw actionable insights.

Finally, IU 6 focuses on presentation and documentation. Learners will develop skills in effectively communicating their findings, creating compelling visualizations, and documenting the entire project process.

Throughout the module, learners will undertake a capstone project that integrates all the learned skills and knowledge. They will develop a comprehensive data science project that involves validating, transferring, integrating, and deploying models using Microsoft Azure. This project will provide learners with hands-on experience in working with real-world datasets, applying data analytics techniques, and effectively presenting their findings.

By successfully completing this module, learners will demonstrate their ability to conceptualize and execute a data analytics project from start to finish. They will gain proficiency in project management, data acquisition and preparation, exploratory data analysis, analytics modelling, results evaluation, interpretation, and effective presentation and documentation. These skills will prepare learners to tackle complex data challenges and contribute to data-driven decision-making processes in various domains.

Module Project:

Project Objective: Develop a data analytics project from proposal to presentation, covering data acquisition, analysis, and interpretation.

Project Task:

1. Task 1: Develop a project proposal and plan with objectives, methodology, and deliverables.
2. Task 2: Prepare and clean data, integrating it from multiple sources for analysis.
3. Task 3: Perform exploratory data analysis to gain insights and visualize relationships.
4. Task 4: Apply modeling techniques to extract meaningful information from data.
5. Task 5: Evaluate and interpret data analytics results, making data-driven recommendations.
6. Task 6: Present findings with compelling visualizations and storytelling techniques.
7. Task 7:Document project process, including methodologies, data sources, and analysis results.

8.2 Module Session Plan

Session No#	Session Type	Day no#	Duration Hrs
1	Mentoring Support – Project Planning -1	1	3
2	Mentoring Support – Projects Implementation 1	2	2
3	Mentoring Support – Project Planning -2	3	3
4	Mentoring Support – Projects Implementation 2	4	2
5	Mentoring Support – Project Planning -3	5	3
6	Mentoring Support – Projects Implementation 3	6	2
7	Mentoring Support – Project Planning -4	7	3
8	Mentoring Support – Projects Implementation 4	8	2
9	Mentoring Support – Project Planning -5	9	3
10	Mentoring Support – Projects Implementation 5	10	2
11	Mentoring Support – Project Planning -6	11	3
12	Mentoring Support – Projects Implementation 6	12	2
13	Mentoring Support – Project Planning -7	13	3
14	Mentoring Support – Projects Implementation 7	14	2
15	Mentoring Support – Project Planning -8	15	3
16	Mentoring Support – Projects Implementation 8	16	2
17	Mentoring Support – Project Planning -9	17	3
18	Mentoring Support – Projects Implementation 9	18	2
19	Mentoring Support – Project Planning -10	19	3
20	Mentoring Support – Projects Implementation 10	20	2
21	Mentoring Support – Project Planning -11	21	3
22	Mentoring Support – Projects Implementation 11	22	2
23	Mentoring Support – Project Planning -12	23	3
24	Mentoring Support – Projects Implementation 12	24	2
25	Summative Assessment (per learner)	25	30 min

Module Name	E-Learning Async	Flipped Class Sync	Assignment Sync	Project Planning Sync	Project Implementation Async
Capstone Project – Data Analytics	0	0	0	36	24

9. Credentials

Name of the Credentials	Details
Academic Qualification	Advanced Certificate in Data Science awarded by Lithan Academy
EduCLaaS Job Role Certification	Associate Data Analyst
Industry Skills Certification	WSQ Data science essentials (SF) • Microsoft Certified: Azure Data Fundamentals WSQ Principles of machine learning (SF) • Microsoft Certified: Azure Data Scientist Associate Taking this certification is not mandatory. However, if the learner wishes to pursue it, they need to register for the examination directly with the vendor after paying the necessary fees.
Statement of Attainment	Data Analytics & Visualization • ICT-DIT-4006-1.1 Data Visualization Data science essentials • ICT-DIT-4005-1.1 Data Engineering Principles of machine learning • ICT-SNA-4011-1.1 Emerging Technology Synthesis Capstone Project -Data Analytics • ICT-PMT-4001-1.1 Business Needs Analysis • ICT-OUS-3011-1.1 Problem Management