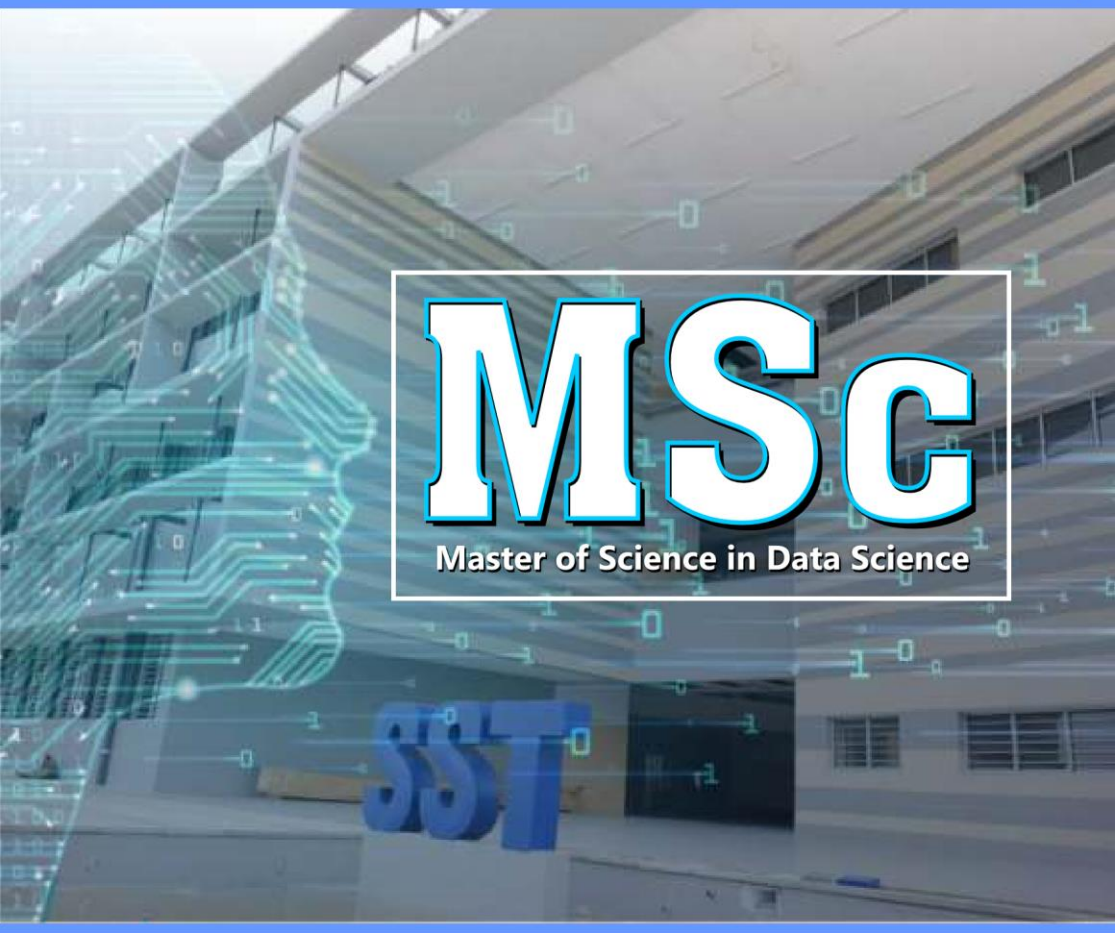
PAN-ATLANTIC
UNIVERSITY

POSTGRADUATE EDUCATION



SCHOOL OF SCIENCE AND TECHNOLOGY
PAN-ATLANTIC UNIVERSITY

MSc

Master of Science in Data Science

SCHOOL OF SCIENCE AND TECHNOLOGY
PAN-ATLANTIC UNIVERSITY

While every effort has been made for the content of this handbook to be as accurate as possible, it is still possible that some modifications could occur as time goes on. Any changes/alterations will be announced by the School.

MORE INFORMATION

Ndidi (0708 864 1465)
Joy (0816 482 0228)
Lekan (0813 555 1765)
David (0701 782 5427)

Admissions Office
Pan-Atlantic University
(Main Campus),
Km 52 Lekki-Epe Expressway,
Ibeju-Lekki, Lagos.
Tel: 234-1-712 1728; 440 5524
www.pau.edu.ng

CONTENT

About Pan-Atlantic University (PAU)

Pan-Atlantic University has a strong Christian identity, which is reflected in campus life and content of the education we offer. One important characteristic of this identity is the openness of the University to people of all races and religions.

The Mission Statement of the University is: "to form competent and committed professionals and encourage them to serve with personal initiative and social responsibility the community in which they work, thereby helping to build a better society in Nigeria and Africa at large".

Pan-Atlantic University contributes to national development through the provision of academic programmes that are relevant to the needs of the country. We are open to all people regardless of their nationality, race, sex, religion or ethnic group

The objective of education in our university is the well-rounded formation of the human person. This is why an important component of every programme is the inclusion of a good number of courses in the humanities. We also seek, by deliberate design of our programmes, to inculcate and groom the entrepreneurial spirit in our students and participants. The university aims at nurturing individuals who are professionally competent, creative and enterprising, zealous for the common good and able to make free and morally upright decisions and who thus act as positive agents of change in service to the society.

The name University implies a universal mentality: openness to other persons, ideas, areas of knowledge, cultures far and near, without discrimination.

The University is also a place that fosters and stimulates study and a permanent search for the truth. This involves the labour of intelligence, intellectual honesty and the desire to learn, combined with the desire to continually overcome one's limits. In addition, university studies require a cultivation of one's own personality and the development of the habits necessary for professional and social life.

"The objective of education in our university is the well-rounded formation of the human person."

About School of Science and Technology (SST)

The School of Science and Technology (SST) is a community of people committed to creating and transmitting knowledge and competencies in science, engineering and technology by "forming competent and socially responsible science and engineering professionals who are committed to the promotion of the common good of society and the advancement of the scientific and engineering profession."

In order to achieve this mission, the School seeks to:

- Provide practice-based, student-centred and industry-relevant programmes that address technical expertise, industrial management, and ethical responsibility.
- Develop partnerships and engage with relevant stakeholders through applied research that provides solutions to industry problems and enhance engineering pedagogy.
- Provide entrepreneurship education along with science and engineering education.

SST offers first degree programmes in the following courses:

- B.Eng programme in Electrical/Electronic Engineering
- B.Eng. programme in Mechanical Engineering
- B.Eng in Mechatronic Engineering
- B.Sc. in Computer Science
- B.Sc. in Software Engineering
- B.Sc. in Data Science

About the Master of Science in Data Science

The Masters in Data Science seeks to bring knowledge about data closer to business expertise by equipping participants with the ability to draw meaningful insights from wide range of structured, semi-structured and unstructured data, with varied levels of sizes and complexities. Participants will acquire the requisite skills needed to identity, extract, prepare, analyze, interpret and present results, with AI-driven enhancements. In addition, participants will be able to lead the implementation of innovative data science projects in real-world environments, applying the concepts to varied sectors of interest.

The masters programme is on the one hand, for anyone whose objective is to acquire professional competence in data science, at the service of the industry. On the other hand, it is a pathway to further specialization at doctoral level.

Rationale/Justification

Data science is a dynamic and rapidly growing area in the present society and predictably in the future society where so much tacit knowledge is hidden in the massive amount of data constantly generated from activities, especially those of digital nature. The need for individuals with good data science skills and understanding who can draw meaningful insights from data cannot be overemphasized. This need will continue to grow.

The following is an outline of rationale/justification for the Data Science programme:

- We are immersed in data especially those that are result of digital footprints
- Expertise in data science enables the graduate to solve complex, challenging problems.
- Data science jobs are here to stay, regardless of where you are located.
- Expertise in data science helps the graduate even if his/her primary career choice is something else.
- Data science offers great opportunities for true creativity and innovativeness, creating value by drawing meaningful insights from data.
- Data science has space for both collaborative work and individual effort.
- Data science is an essential part of well-rounded academic preparation.
- Future opportunities in data science are without boundaries.

Philosophy of the programme

The fundamental aim of the programme is tied to that of the University and it is to form competent and socially responsible data science professionals who are committed to the promotion of the common good of society and the advancement of the data science profession.

The MSc programme in Data Science of the Pan-Atlantic University is informed by the aspiration to train data science professions to bring knowledge of data analytics closer to business expertise by equipping participants with the ability to draw meaningful insights from wide range of structured, semi-structured and unstructured data, with varied levels of sizes and complexities. The participants will be trained to uphold the highest intellectual, ethical and professional values that promote creativity, critical knowledge, social responsibility, and the spirit of enterprise. The programme will prepare students for careers in data science in private and public sectors alike. With the skills students will acquire in this programme, they will be better equipped to improve individual and corporate performance, with the resultant impact on national productivity and economic growth.

Aims/Objectives of the Programme

The vision of the School is to be internationally recognized as a prestigious institution offering high-class education in Science and Technology disciplines; to be a reference point for research in Africa, and a leading training centre for science and technology practitioners. It is expected that the level and high standard of the School will influence positively all other faculties of its nature across the country.

As part of the programme's specific objectives, participants will acquire the requisite skills needed to identity, extract, prepare, analyze, interpret and present results, with AI-driven enhancements. In addition, participants will be able to lead the implementation of innovative data science projects in realworld environments, applying the concepts to varied sectors of interest.

The master's programme is on the one hand, for anyone whose objective is to acquire professional competence in data science, at the service of the industry. On the other hand, it is a pathway to further specialization at doctoral level.

"The programme will prepare students for careers in data science in private and public sectors alike."

Entry Requirements

- At least hold a bachelor degree in any information science related discipline
- (HND holders require an additional Postgraduate Diploma in a relevant field)
- Be fluent in English language

Graduation Requirements

The following regulations shall govern the conditions for the award of Master of Science (MSc) degree:

(a) Candidates should have registered for a minimum of 42 units of courses.
(b) Candidates must have registered and passed all the compulsory courses specified for the programme.

Minimum number of Earned Credit Hours for graduation:

To graduate, the candidates must have passed a minimum of 30 units (which must include the compulsory units).

Minimum No. of years for graduation:

One year

Programme Overview

Full-time Equivalent

- **Duration:** 11 Months (spread across two semesters)
- **Total Required Credit per Semester:** 24

Modular Delivery Approach (Employment compatible)

- **Duration:** 14 Months (spread across three semesters)
- **Total Required Credit per Semester:** 15

(18 for 3rd Semester which includes 6 for Thesis)

[Only the modular delivery approach is available at this time]

Pre-first-semester Brush-up Phase:

- Candidates judged to be inadequately technically prepared to begin the first semester work, will be required to go through a self-paced Brush-up Curriculum. Participating in this phase is optional for the rest.
- **Duration:** 2 months (prior to first semester date)

The Brush-up Curriculum includes (in order):

1. Programming Primer
2. Statistics Primer
3. Mathematics Primer

Calendar Summary (Modular):

- **Brush-up Phase:** July to August inclusive
- **Semester 1:** September to December inclusive. Examinations in the second week of December.
- **Semester 2:** January to May inclusive. Examinations in mid-May.
- **Semester 3:** May to August inclusive. Examinations in the last week of August
- **Dissertation Defense** in October
- **Convocation** in December

Lectures

- **Electronically:** Every Saturday (except Convocation and Intensive weeks)
- **Physically:** Two Intensive Weeks (Monday to Friday) per Semester
- **Engagement on eLearning Platform:** Continuous

Course Descriptions

First Semester

Course Code	Course	Credit
DAT601	Fundamentals of Data Science and analytics	3C
DAT603	Statistical Methods	3C
DAT605	Database Modeling and Database systems	3C
DAT607	Foundational Mathematics for Data Science	3C
DAT609	Research Methodology for Data Science	3C
DAT611	Tools and Platforms for Data Science	3C
DAT613	Programming for Data Science	3C

First Semester Elective Courses (Full-time Equivalent):

Course Code	Course	Credit
DAT615	Computer Vision and Internet of Things (IoT)	3E

DAT617	Data Management, Visualization and Presentation	3E
DAT619	Predictive Analytics for Business	3E

Second Semester (Full-time Equivalent):

Course Code	Course	Credit
DAT602	Business Cases and Analysis	3C
DAT604	Machine Learning	3C
DAT606	Deep Learning	3C
DAT608	Big Data Technologies	3C
DAT610	Ethics and Privacy	3C
DAT612	Masters Thesis	6C

Second Semester Elective Courses (Full-time Equivalent):

Course Code	Course	Credit
DAT614	Advanced Mathematical Methods for Data Science	3E
DAT616	Natural Language Processing	3E
DAT618	Bioinformatics	3E
DAT620	Blockchain, Web and Mobile Technologies	3E

Syllabus (Modular)

First Semester (Modular Equivalent):

Course Code	Course	Credit
DAT601	Fundamentals of Data Science and Analytics	3C
DAT605	Natural Language Processing	3C
DAT607	Foundational Mathematics for Data Science	3C
DAT609	Research Methodology for Data Science	3C
DAT613	Programming for Data Science	3C

Second Semester (Modular Equivalent):

Course Code	Course	Credit
DAT603	Statistical Methods	3C
DAT611	Tools and Platforms for Data Science	3C
DAT602	Business Cases and Analysis	3C
DAT604	Machine Learning	3C
DAT606	Deep Learning	3C

Third Semester (Modular Equivalent):

- Made up of Core Courses and Electives
- At least 6 credit units of Electives (i.e., two courses) must be taken and passed. A student may however enroll for up to three (max) Elective courses, if available.

Core Courses in Third Semester

Course Code	Course	Credit
DAT608	Big Data Technologies	3C
DAT610	Ethics and Privacy	3C
DAT612	Master's Thesis	6C

Electives

(Only the top three in accordance with demand will be offered in each academic session)

Course Code	Course	Credit
DAT615	Computer Vision and Internet of Things (IoT)	3E
DAT617	Data Management, Visualization and Presentation	3E
DAT619	Predictive Analytics for Business	3E
DAT614	Advanced Mathematical Methods for Data Science	3E
DAT616	Natural Language Processing	3E
DAT618	Bioinformatics	3E
DAT620	Blockchain, Web and Mobile Technologies	3E

Course Description

DAT 601: Fundamentals of Data Science and Analytics

This course provides an accessible, nontechnical overview of the field, covering the vocabulary, skills, jobs, tools, and techniques of data science and analytics.

Students will learn to identity the relationship between data science and other data-driven fields such as machine learning and artificial intelligence.

They will review the primary practices: gathering and analyzing data, formulating rules for classification and decision-making, and drawing actionable insights.

By the end, students would have learnt how data science can help them make better decisions, gain deeper insights, and make their work more effective and efficient.

DAT 603: Statistical Methods

In this course, students will develop a deep understanding of the principles that underpin statistical inference: estimation, hypothesis testing and prediction.

By the end of the course, students should be able to:

- Calculate and apply measures of central tendency and measures of dispersion to grouped and ungrouped data.
- Summarize, present, and visualize data in a way that is clear, concise, and provides a practical insight for non-statisticians needing the results.
- Identify appropriate hypothesis tests to use for common data sets.

- Conduct hypothesis tests, correlation tests, and regression analysis.
- Demonstrate proficiency in statistical analysis

DAT 605: Database Modeling and Database Systems

In this course, students will learn the overview of Database Management, Conceptual Database Design, Logical Database Design, and Physical Database Design.

At the end of the course, students should be able to understand

- Relational Database: Relation, Optimization.
- Relational Model
- Structured Query Language (SQL)
- NoSQL

DAT 607: Foundational Mathematics for Data Science

Calculus and linear algebra are fundamental concepts in modern mathematics, with applications ranging from statistics and data science to economics, physics, and electrical engineering. Learning the topic, on the other hand, is more about becoming fluent in its language and theory than it is about obtaining computing skills.

Students will learn how to solve Gradient Descent issues using differential and integral calculus in this course. They will also learn about the connections between linear equations, matrices, and linear transformations, as well as the fundamentals of vector and matrix operations, the importance of the base and size of a vector space, and the applications of inner products and orthogonality.

Topics include:

- Equations, combinatorics, and indices.
- Set theory
- Functions and graphs
- Series, inequalities
- Vector Algebra: Scalars and Vectors (Addition, multiplication)
- Matrix algebra
- Calculus (Differentiation and Integration)

DAT 609: Research Methodology for Data Science

This course exposes students to all aspects of research design, data gathering, analysis as well as project/dissertation writing. Special attention will be paid to design of experiments for data science

DAT 611: Tools and Platforms for Data Science

This course introduces the students to a wide range of data science tools and platforms for solving day to day business problems. These will include those for capture, analysis (including big data analysis), visualization, etc.

At the end of this course, students should be able to use tools like:

- Rstudio
- Jupyter
- VS Code
- SAS
- Stata
- Excel
- Power BI
- Tableau for visualization

And platforms like:

- Microsoft azure
- Google cloud

DAT 613: Programming for Data Science

In this course, students will learn the programming fundamentals required for a career in data science. By the end of the course, students will be able to use Python, R, SQL, requisite python libraries like panda, as well as Git for version control and team collaboration.

DAT 615 (Elective): Computer Vision and Internet of Things (IoT)

This course on the one hand, provides students with computer vision and deep learning techniques. From basic image processing, to building and customizing convolutional neural networks. At the end of this course, students should be able to apply these concepts to vision tasks such as automatic image captioning and object tracking, and build a robust portfolio of computer vision projects.

On the other hand, the course exposes the students to the world of Internet of Things (IoT). The internet of things (IoT), which was once a hazy concept, is now a widespread reality. Consumers and organizations may choose from a wide range of gadgets and services. Internet of things technologies have an influence on our lives and environments, from smart homes to smart cities, from smart gadgets to smart industries.

This course takes a top-down approach, covering a wide range of topics related to the internet of things. It begins with use cases and hazards from the viewpoints of users and companies and concludes with the internet of things' technological underpinning. A collection of strategies is provided to handle the engineering perspective.

Computer vision combined with IP connectivity is explored as a strong basis for innovations in the IoT world.

DAT 617 (Elective): Data Management, Visualization and Presentation.

In order to create meaningful visual representations of data, it is important to have a well-conceived data management framework. This requires the right backend storage, a paradigm for data access, and an engaging front-end for presentation and analysis. In this course, students will learn the art of data management, visualization and presentation that address real world business problems.

DAT619: Predictive Analytics for Business

This course provides students with the scientific approach to solving problems with data. Students will learn geospatial analysis, how to perform A/B testing, Time series analysis and more!!

At the end of this course, students would have learnt to:

- Create mental models to clearly define business issues.
- Visualize and prepare data to improve efficacy of predictive models.
- Identify and implement a variety of predictive modeling techniques.

DAT602: Business Cases and Analysis.

Doing Data Science without a sense of business is like playing chess without the kings on the board. For every business, making its products or services better is the ultimate goal of a data science

project. This course introduces the students to a wide range of business problems.

At the end of course, students must have worked on different capstone projects and presented some seminar topics in data science.

DAT604: Machine Learning

Machine learning methods are commonly used across engineering and sciences, from computer systems to physics. Moreover, commercial sites such as search engines, recommender systems (e.g., Netflix, Amazon), advertisers, and financial institutions employ machine learning algorithms for content recommendation, predicting customer behavior, compliance, or risk.

As a discipline, machine learning tries to design and understand computer programs that learn from experience for the purpose of prediction or control.

In this course, students will learn about principles and algorithms for turning training data into effective automated predictions.

DAT606: Deep Learning

Traditional neural networks rely on shallow nets, composed of one input, one hidden layer and one output layer. Deep-learning networks are distinguished from these ordinary neural networks by having more hidden layers, so-called more depth. These kinds of networks are capable of discovering hidden structures within unlabeled and unstructured data (e.g. images, sound, and text), which constitute the vast majority of data in the world.

In this course, students will learn different types of Deep Learning Architectures, such as Convolutional Networks, Recurrent Networks

and Autoencoders and then apply them to solving real world problems.

DAT608: Big Data Technologies

Organizations now have access to massive amounts of data and it's influencing the way they operate. They are realizing that in order to be successful they must leverage their data to make effective business decisions. In this course, students will learn how big data is driving organizational change and the key challenges organizations face when trying to analyze massive data sets.

Furthermore, they will develop their knowledge of big data analytics and enhance their programming and platform skills. They will enhance their knowledge of platforms such as Apache Kafka, Apache Spark, Trino, etc.

DAT610: Ethics and Privacy

Handling data about persons naturally calls for ethical considerations. It is important for a data scientist to have a good understanding of the principles of ethics and in particular, its applicability to data privacy issues. In this course, students will learn about general and business ethics especially as they relate to data handling.

DAT612: Master Thesis

DAT614 (Elective): Advanced Mathematical Methods for Data Science

This course aims to give students the mathematical background knowledge needed to apply and comprehend contemporary

engineering and science methodologies and approaches, especially as they apply to machine learning algorithms To that purpose, the course begins with a review of calculus principles. The concepts of differentiation and integration, as well as crucial extensions to many dimensions, are introduced. The calculus of variations, a frequently utilized optimization tool, is also explained. Integral transformations are also explored, which are important in scientific and engineering applications.

These analytical tools are supplemented by a detailed introduction to linear algebra-related mathematical methods. In addition, the idea of a tensor is presented, which is fundamental in many common techniques to machine learning. Topics include:

- Calculus
- Integral Transformation: Convolutions, Fourier Transformations
- Vector Calculus
- Matrix algebra: Tensors
- Numerical Methods for Linear Equations and Matrices
- Information Theory: Entropy, Shannon Entropy, Kulback-Leibler Divergence, Cross Entropy.

DAT616 (Elective): Natural Language Processing

In this course, students will learn cutting-edge natural language processing techniques to process speech and analyze text. Build probabilistic and deep learning models, such as hidden Markov models and recurrent neural networks, to teach the computer to do tasks such as speech recognition, machine translation, and more!.

Understanding the fundamental principles of NLP allows student to perform essential functions for businesses.

Speech recognition builds a robust customer service branch. Part of speech tagging helps build flexible databases. Accurate Machine translation opens up possibilities for international expansion.

DAT618 (Elective): Bioinformatics

Bioinformatics, also known as Biomedical Informatics, is a multidisciplinary field that tries to comprehend, arrange, and analyze enormous volumes of biological data using specialized software tools. Bioinformatics contributes to scientific experimentation and study by assisting in the knowledge of disease genetics, how unique adaptations develop, the discovery of new agricultural species, and the analysis of variations between various organism populations.

In this course, students will learn the fundamentals of bioinformatics and become proficient in utilizing the theories taught.

DAT620 (Elective): Blockchain, Web and Mobile Technology

A digital revolution is currently underway with respect to how transactions are carried out. The emergence of bitcoin cryptocurrency exposed the potential benefits of the underlying blockchain technology for business transactions.

Professionals who understand the implications of blockchain technology, and more concretely how to leverage on it for better data management and integrity, can help their companies connect and serve their customers and stakeholders with efficiency and precision, creating new opportunities and staying ahead of competition.

The Blockchain revolution so far seems to be going hand in hand with the well-established Web and Mobile approaches to solutions delivery. Therefore, Web and Mobile apps development will also be put in perspective in this course.

In this course, students will learn…

- The core concepts behind blockchain technology, and how to complement it with insights from data, to solve complex business problems.
- How to create data-driven web and mobile platforms.

PAN-ATLANTIC
UNIVERSITY

Main Campus
Km 52, Lekki-Epe Expressway,
Ibeju Lekki, Lagos.
P.O.Box 73688, Victoria Island, Lagos
Tel: +234 (01) 712 1728; 440 5524