SORBONNE UNIVERSITY ABU DHABI

Bachelor in

MATHEMATICS

SPECIALISATION IN DATA SCIENCE FOR ARTIFICIAL INTELLIGENCE

COURSE CATALOGUE FOR THE 2025-2026 ACADEMIC YEAR

Three-year degree delivered by Sorbonne Université.

Developed in cooperation with the department of Mathematics at Sorbonne Université, this Bachelor programme equips students for careers in artificial intelligence by providing a deep and fundamental knowledge of data science algorithms.

Mathematics, Specialisation in Data Science for Artificial Intelligence

Programme Code: 6-L-MATH

Level: Undergraduate

Credits and Duration: 201 ECTS credits taken over 6 semesters - 36 months full time.

Delivery Language: English

Learning Outcomes

PLO 1	Demonstrate knowledge and understanding of diverse areas in mathematics, such as: Analysis, Algebra, Discrete Mathematics, Probability and Statistics.
PLO 2	Demonstrate knowledge and understanding of the fundamentals of Data Science and Machine Learning as well as appreciate the societal / philosophical impact of the technologies stemming thereof.
PLO 3	Develop a tangible set of skills to mine information from high-dimensional data sets and use them in prediction, both in academic and in industrial setups.
PLO 4	Demonstrate a consolidated technical grounding in mathematical, statistical and computational techniques and use them in a problem-solving perspective to address both theoretical and practical applications.
PLO 5	Acquire proficiency in extracting / interpreting mathematical, statistical and computational information and in communicating such content clearly and coherently.
PLO 6	Use previously acquired mathematical, statistical and computational knowledge to explore new, more advanced such content, be it either for addressing novel complex applications or to engage in basic research activities.

Programme Overview:

The goals of the Bachelor in Mathematics, Specialisation in Data Science for Artificial Intelligence are to:

- Provide students with an in-depth exposure to diverse areas of mathematics, such as Analysis, Algebra, Discrete Mathematics, Probability and Statistics.
- Provide students with an in-depth exposure to the theoretical foundations and the operational techniques of Data Science and Machine Learning, as well as to the main modelling tools / digital information environments which are typically used in those fields.
- Develop strong critical thinking skills, which coupled with the technical competencies acquired in the Bachelor, guarantees advanced analysis, modelling and problem-solving capabilities needed in Business and industrial setups.
- Provide students with the necessary background to further pursue their studies in Mathematics and / or Data Science and Machine Learning, should they wish to do so.

Programme Structure: The Bachelor in Mathematics, Specialisation in Data Science for Artificial Intelligence requires the successful completion of 201 ECTS comprising:

	UE	Course code	Course name	Credits	Date
1st Semester	UL1MA001	MATH-100	Mathematics 1	9	Sep – Dec 2025
	UL1MEPY1	PHYS-125	Mechanics-Physics 1	6	Sep – Dec 2025
	UL1SXOIP	PHYS-105	Introduction into the World of Work 1	3	Sep – Dec 2025
	UL1MAAD1	MATH-113	Philosophy and Ethics of Artificial Intelligence	6	Sep – Dec 2025
	UL1IN001	CPSC-100	Computer Science	6	Sep – Dec 2025
	UL1LVAD2	SCEN-101	Languages	3	Sep – Dec 2025

	UE	Course code	Course name	Credits	Date
2nd Semester	UL1MA002	MATH-114	Mathematics 2	5	Jan – May 2026
	UL1MA003	MATH-160	Complements in Analysis and Linear Algebra	8	Jan – May 2026
	UL1MAAD2	MATH-176	Algebra and Number Theory	4	Jan – May 2026
	UL1MAAD3	MATH-177	Mathematical Methods for Data Science	10	Jan – May 2026
	UL1SXAR2	MATH-175	Active Science: Project in Descriptive Statistics	3	Jan – May 2026
	UL1LVAD2	SCEN-101	Languages	3	Jan – May 2026

	UE	Course code	Course name	Credits	Date
3rd Semester	**LU2MA260**	MATH-220	Sequences and Series of Functions	6	Sep – Dec 2025
	LU2MA216	MATH-226	Topology and Analysis 1	6	Sep – Dec 2025
	LU2MA221	MATH-222	Linear and Bilinear Algebra 1	6	Sep – Dec 2025
	LU2MA440	MATH-250	Discrete Probability, Combinatorics and Graphs	12	Sep – Dec 2025
	UL1LVAD2	SCEN-101	Languages	3	Sep – Dec 2025

	UE	Course code	Course name	Credits	Date
4th Semester	**LU2MA241**	MATH-255	Introduction to Probability Models	6	Jan – May 2026
	LU2MA312	MATH-230	Lebesgue Integrals and Complements in Probability Theory	9	Jan – May 2026
	LU2MA122	MATH-232	Linear and Bilinear Algebra 2	6	Jan – May 2026
	LU2MA392	MATH-260	Multivariate Data Analysis	9	Jan – May 2026
	UL1LVAD2	SCEN-101	Languages	3	Jan – May 2026

	UE	Course code	Course name	Credits	Date
5th Semester	**LU3MA264**	MATH-330	Measure and Integration Theory	6	Sep – Dec 2025
	LU3MA260	MATH-336	Topology and Analysis 2	6	Sep – Dec 2025
	LU3MA490	MATH-350	Statistical Inference	12	Sep – Dec 2025
	LU3MA276	MATH-351	Algebra & Cryptography	6	Sep – Dec 2025
	LU3FLE01	SCEN-101	Languages	3	Sep – Dec 2025

	UE	Course code	Course name	Credits	Date
6th Semester	**LU3MA391**	MATH-355	Advanced Probability Theory	9	Jan – May 2026
	LU3MA310	MATH-346	Functional Analysis	9	Jan – May 2026
	LU3MA180	MATH-370	Data Science and Machine Learning	12	Jan – May 2026
	LU3MAOI1	MATH-301	Integration to the World of Work 2	3	Jan – May 2026
	LU2FLE02	SCEN-101	Languages	3	Jan – May 2026

Bachelor 1 - Semester 1

Course code and title	**MATH-100 – *Mathematics 1***
Instructor	Dr Omar El Dakkak – Dr Grace Younes
Date	Sep – Dec 2025
Course format	Weekly class
Credits	9
Contact hours	90 - Total Time Commitment: 90
Course description	This course constitutes a thorough and rigorous introduction to univariate and multivariate differential calculus. Students are first introduced to Euclidean spaces and their main algebraic and topological properties. After this introduction, a rigorous treatment of the limit operation is presented, both for real functions of one variable and of several variables. Follows a thorough treatment of continuity and differentiability, once more for real functions of one and of more than one variable. Elements of optimisation are then introduced. The course ends with an introduction to primitivising and to the basic theory of differential equations. More specifically, separable variables differential equations, first-order linear differential equations as well as second-order differential equations with constant coefficients will be analysed in detail.
Evaluation	50% CC, 50% CF

Course code and title	**PHYS-125 – *Mechanics-Physics 1***
Instructor	Dr Eliane Bsaibess
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	64 - Total Time Commitment: 64
Course description	This course covers the concepts and theories related to mechanical and thermodynamic equilibrium of macroscopic systems at rest or under a uniform linear motion. The course will include the study of four main topics. 1. **Dimensions in mechanics and physics,** where we will cover the concepts of physical quantities, dimensions, and units. 2. **Equilibrium of mechanical systems,** where we will introduce the concepts and methods to study the equilibrium of a mechanical system, including Newton's laws, the notion of forces, and the rotational and translational equilibrium. 3. **Hydrostatics,** where we will present the equations utilised for studying the equilibrium in fluids (gases or liquids) and immersed solids. 4. **Thermodynamics,** where we will introduce the quantities used to describe the state of a thermodynamic system, introducing the concepts of temperature and heat.
Evaluation	40% CC, 40% CF, 20% Lab Report

Course code and title	**PHYS-105 – *Introduction into the World of Work 1***
Instructor	Dr Valerie Le Guyon – Part-time Dr Mai El Sawy
Date	Sep – Dec 2025
Course format	Weekly class
Credits	3
Contact hours	30 - Total Time Commitment: 30
Course description	In this course, students will explore their own self, career aspirations, and the world around them. They will be armed to harmoniously face a professional world that is in continuous evolution. They will reflect on their career. The course explores two aspects. The first aspect focuses on the individual, through self-assessment and learning skills such as writing a CV and presenting oneself. The second aspect focuses on global trends and their current and future impact on the individual, society and economy. More precisely, students learn how the world of work is changing. As a result, they are made aware of the nature of competencies that will be relevant in the future and how their newly acquired skillsets can be employed to foster a successful career. The specific case of mathematicians and physicists will be tackled along the course.
Evaluation	100% CC

Course code and title	**MATH-113 – *Philosophy and Ethics of Artificial Intelligence***
Instructor	Dr Claude Vishnu Spaak
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	In the midst of the digital transformation shaping the 4th Industrial Revolution – described by the World Economic Forum as a "fusion of technologies (…) blurring the lines between the physical, digital, and biological spheres" (Schwab, 2016), Artificial Intelligence (AI) stands at the heart of this change. This introductory course examines the key philosophical questions surrounding AI, focusing on epistemological, ontological and ethical issues raised by its development and deployment. From an ethical perspective, AI promises to enhance human life by improving the efficiency and accuracy of critical domains such as medicine, transportation, education, and environmental sustainability. Yet, AI systems are not infallible: as human-designed tools, they inherit human limitations and biases. How, then, can we assign moral responsibility for AI's decisions and mistakes? Given the diversity of ethical theories, which moral frameworks should guide AI design, and how do we navigate conflicts between competing norms? But most importantly, AI poses core epistemological and metaphysical problems: what is the nature of the intelligence at work in AI? Is AI merely an advanced calculator mimicking human cognition without true awareness or understanding? Or does it prompt us to reconsider classical concepts of intelligence, consciousness, and reason, traditionally tied to the human mind, and explore intelligence as a broader adaptive capacity that may manifest differently in artificial systems? By the end of the course, students will be equipped to critically analyse the philosophical foundations of AI, engage with ethical dilemmas it poses, and reflect on its broader metaphysical implications, while examining core questions at the intersection of philosophy, cognitive science, psychology and computer science.
Evaluation	50% CC, 50% CF

Course code and title	**CPSC-100 – *Computer Science***
Instructor	Dr Damien Jamet – Dr Sumant Kumar
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The computer science course is divided into two parts. **Part 1: Introduction to the programming language Python (multi-platform language).** • Master the skills to navigate online notebooks and work with the Spyder interface using Anaconda navigator. • Explore and grasp the basic notions of data structure like lists and arrays. • Familiarise with practical modulus and their built-in functions. • Develop logical reasoning abilities through for and while loops, and apply constructive algorithms to solve problems in mathematics, statistics, and image processing. **Part 2: Introduction to the typesetting scientific text editor LaTex.** • Explore and grasp the basic notions of representing a good report • Acquire the skills to represent a presentation using Beamer. The course concludes with a comprehensive understanding of both Python and LaTex in relation to scientific text editing.
Evaluation	50% CC, 50% CF

Course code and title	**SCEN- 101 – *Languages***
Instructor	Part-time Karima Bendjaballah
Date	Sep – Dec 2025 / Jan – May 2026
Course format	Weekly class
Credits	3 per semester
Contact hours	39 (Total hours for semester 1 and 2)
Course description	This course covers the concepts and theories related to French Language skills, it includes reading, writing, speaking and listening learnings as well as grammar and engaging student in simple discussions on day to day topics. This course introduces the fundamental elements of the French language within a cultural context. Emphasis is on the development of basic listening, repeating, pronunciation, dictation, speaking, reading, and writing skills. Upon completion, students should be able to comprehend and respond with grammatical accuracy to spoken and written French as well as demonstrate cultural awareness. The method used is from the book Atelier A1: textbook and workbook. The level of knowledge the students should reach further to this course's sessions is half way towards A1 Level on the CEFR (French CECR) scale. There are 2 units, each unit will take around 10 to 12 hours to work through. At the end of each unit there are exercises to test the progress of students. These skills are reinforced by videos, songs, sketches, dialogues in situation. We use materials such as the Digital Back, to facilitate the acquisition of these skills.
Evaluation	100% CC

Bachelor 1 - Semester 2	
Course code and title	**MATH-114 – *Mathematics 2***
Instructor	Dr Grace Younes
Date	Jan – May 2026
Course format	Weekly class
Credits	5
Contact hours	50 - Total Time Commitment: 50
Course description	This course covers matrix theory and linear algebra, emphasising topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in physics, artificial intelligence, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Topics include systems of linear equations, matrices, matrix algebra, determinants and inverses, linear combinations, linear independence, and R^n subspaces. We also consider linear transformations, isomorphisms, matrix representation of linear maps, eigenvalues and eigenvectors, diagonalisation, similarity and inner product spaces.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-160 – *Complements in Analysis and Linear Algebra***
Instructor	Dr Sudarshan Shinde – Dr Gianluca Mola
Date	Jan – May 2026
Course format	Weekly class
Credits	8
Contact hours	80 - Total Time Commitment: 80
Course description	The purpose of this course, which, unlike MATH 100 and MATH 200 is programme-specific, is to provide a deeper, more rigorous treatment of some of the topics seen in MATH 100 and MATH 200, as is suitable for mathematicians. The course is divided in two parts: the first part provides complements in Analysis and the second parts provides complements in Linear Algebra. More precisely, the Analysis part starts with a thorough study of convergence of complex and real-valued sequences and the Bolzano-Weierstrass Theorem, it follows on with a theoretically complete study of limits, continuity and derivability of real functions of a real variable, and of sequences defined through a recursion. It ends with a rigorous presentation of Riemann integrals. The Linear Algebra part (which telescopes the Linear Algebra part of MATH 200), starts with a complete, rigorous presentation of the theory of vector spaces, exhibiting how not only Euclidean spaces enjoy this structure but also suitable spaces of sequences and general functions do enjoy it. In this framework, the theory of linear maps is developed and, once more, it is shown that rather abstract operators (such as differentiation) can be considered as linear maps. The course ends with a rigorous presentation of the theory of diagonalisation of linear maps.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-176 – *Algebra and Number Theory***
Instructor	Dr Grace Younes
Date	Jan – May 2026
Course format	Weekly class
Credits	4
Contact hours	40 - Total Time Commitment: 40
Course description	This course provides first an introduction to the basic concepts and results of mathematical logic and set theory through basic logical structures and the concepts of classes and sets, functions, relations, and partially ordered classes. In the second part of the course, students are introduced to abstract algebra. In particular, basic mathematical structures such as groups and rings are introduced and studied.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-177 – *Mathematical Methods for Data Science***
Instructor	Dr Omar El Dakkak – Dr Samuel Feng
Date	Jan – May 2026
Course format	Weekly class
Credits	10
Contact hours	100 - Total Time Commitment: 100
Course description	The course is a hands-on introduction to Data Science, divided into two parts. • Part 1 develops the notions of random variables, random vectors, and their laws, as well as those of transformations of random variables and vectors. Other topics include expectation, characteristic functions, laws of large numbers, and the central limit theorem. • Part 2 develops the coding skills necessary for implementing and applying these crucial concepts in data analysis. The entire lifecycle of data analysis is covered, from importing data and cleaning to visualisation, modelling, and reporting results. Students implement this process on real world datasets using the R programming language.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-175 – *Active Science: Project in Descriptive Statistics***
Instructor	Dr Tanujit Chakraborty
Date	Jan – May 2026
Course format	Weekly class
Credits	3
Contact hours	30 - Total Time Commitment: 30
Course description	This course, whose assessment is exclusively project-based, is strictly linked to MATH 170 - Descriptive Statistics and Introduction to R. In fact, this course will telescope with MATH 170 and will consist eminently of Computer Labs dedicated to guiding he students in their preparation of the projects. The format of the course is highly non-conventional in that it will, in no small measure, consist of collective discussions and proposed resolutions of possible problems, difficulties and challenges met by students in the preparation of their project.
Evaluation	100% CC

Bachelor 2 - Semester 1

Course code and title	**MATH-220 – *Sequences and Series of Functions***
Instructor	Dr Samuel Feng – Dr Gianluca Mola
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The course presents students with the essentials of the theory of numerical series and the series of functions theory. It starts with a detailed presentation of the criteria for the convergence of numerical series. Then, the theory of function sequences is presented. In particular, the notions of pointwise and uniform convergence are introduced and analysed together with their relationship with continuity, differentiability and integrability. Relevant results for the analysis of general series of functions are also presented in this context. The second half of the course is dedicated to the detailed presentation of the theory of (complex-valued) power series and Fourier series. The course ends with some relevant applications in Sciences.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-226 – *Topology and Analysis 1***
Instructor	Dr Safaa Al Sayed – Dr Sudarshan Shinde
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The course follows on the contents of MATH 200 and of MATH 160, introducing students first to the fundamental notions of Topology in R^n then to those of multivariable Analysis. Thus, in the first part of the course, students learn about different norms on R^n and their topological equivalence, the notions of open, closed, bounded, compact and connected sets as well as the topological definition of continuity. This part ends with the study of the fixed-point Theorem. In the second part of the course, the general theory of differential (real and vector valued) functions on R^n is presented. In particular, partial and directional derivatives, the Jacobian and the differential of a function, (continuously) differentiable functions, diffeomorphisms and parametric curves are studied in the first place. Next, the finite-increments formula is presented, followed by the multivariate Taylor formula. The course ends with a study of critical points in the interior of the domain of a differentiable map.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-222 – *Linear and Bilinear Algebra 1***
Instructor	Dr Lama Tarsissi
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	Following on the notions of determinants, eigenvalues, eigenvectors and on change of basis formulae, all of which are topics seen in L1, this course starts by treating eigenspaces and their use in characterising diagonalisable operators, dual spaces and the associated notion of linear forms, highlighting its importance in differential calculus and in the representation of quadratic forms. The second part of the course consists of the study of Euclidean spaces (i.e. non-necessarily complete, inner product real vector spaces) in the framework of which the orthogonal group, the Gram-Schmidt orthogonalisation procedure and the QR decomposition are presented. The third part of the course presents the general theory of symmetric bilinear forms, leading to the computation of the signature of a quadratic form. Finally, the fourth and last part of the course introduces pre-Hilbert complex spaces and Hilbert spaces.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-250 – *Discrete Probability, Combinatorics and Graphs***
Instructor	Dr Miklos Ruszinko
Date	Sep – Dec 2025
Course format	Weekly class
Credits	12
Contact hours	120 - Total Time Commitment: 120
Course description	The aim of this course is to provide students with the main structures of Discrete Mathematics and the typical tools from Probability Theory needed to model the introduction of randomness on these structures. In the first part, students are introduced to the main principles of enumeration and to basic combinatorial quantities, the progression in this part leading to teaching students to solve homogeneous linear recursions using formal power series. The second part of the course focuses on introducing and familiarising students with graphs and trees, as well as the different structural properties that contribute to their characterisation. In the third and last part of the course, after introducing the fundamentals of Probability Theory (probability spaces, conditional probability, random variables, moments) students will study some special topics / tools of relevance in the modelling of random discrete structures: probability generating functions, enumerative probabilities, introduction to random graphs.
Evaluation	50% CC, 50% CF

Bachelor 2 - Semester 2	
Course code and title	**MATH-255 – *Introduction to Probability Models***
Instructor	Dr Samuel Feng
Date	Jan – May 2026
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The course constitutes a non-measure-theoretic introduction to Stochastic Processes. In the first part of the course, after a brief reminder of the main discrete and continuous laws, the theory of multivariate distributions is presented, leading to the treatment of conditional laws, conditional expectations and independence. In the second part of the course, a number of archetypical Stochastic processes, widely used in applications, are presented. In particular, the course develops a self-contained, introductory, albeit exhaustive, treatment of Branching processes, Random Walks, Markov Chains and Poisson processes and some of their principal applications.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-230 – *Lebesgue Integration Theory and Complements in Probability***
Instructor	Dr Sudarshan Shinde – Dr Omar El Dakkak
Date	Jan – May 2026
Course format	Weekly class
Credits	9
Contact hours	90 - Total Time Commitment: 90
Course description	The aim of this course is twofold: on the one hand, to provide students with a rigorous treatment of Real Analysis from the measure-theoretic point of view and a rigorous treatment of Probability Theory on Euclidean spaces. The connections between a measure-theoretic concept and its probabilistic counterpart will be constantly underlined all along the course, the aim being to put rigour on the intuitive notions seen in earlier and parallel Probability-based courses in L2. With this in mind, the course starts with the general definition of a sigma-field and of measures moving on to the construction of Lebesgue measure on R^n. Moving from there, the notion of measurable function (random variable) is introduces and the Lebesgue integral is constructed (references to the probabilistic notions of expectation and moments are carefully made). Next, convergence theorems are presented, along with celebrated (measure theoretic and probabilistic) inequalities (Cauchy-Schwarz, Hölder, Markov, Chebyshev, etc.). The final part of the course touches on product measures, multiple integrals and Fourier transforms, hence on sequences of independent random variables, characteristic functions leading the way to the treatment of laws of large numbers and the Central Limit Theorem.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-232 – *Linear and Bilinear Algebra 2***
Instructor	Dr Gianluca Mola
Date	Jan – May 2026
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	Following on the notions of determinants, eigenvalues, eigenvectors and on change of basis formulae, all of which are topics seen in L1, this course starts by treating eigenspaces and their use in characterising diagonalisable operators, dual spaces and the associated notion of linear forms, highlighting its importance in differential calculus and in the representation of quadratic forms. The second part of the course consists of the study of Euclidean spaces (i.e. non-necessarily complete, inner product real vector spaces) in the framework of which the orthogonal group, the Gram-Schmidt orthogonalisation procedure and the QR decomposition are presented. The third part of the course presents the general theory of symmetric bilinear forms, leading to the computation of the signature of a quadratic form. Finally, the fourth and last part of the course introduces pre-Hilbert complex spaces and Hilbert spaces.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-260 – *Multivariate Data Analysis***
Instructor	Dr Samuel Feng
Date	Jan – May 2026
Course format	Weekly class
Credits	9
Contact hours	90 - Total Time Commitment: 90
Course description	The aim of this course is to provide students a general introduction to statistical methods for multivariate data analysis. The idea is to communicate to the students the statistical tools that are necessary to extract relevant information from any dataset. This course addresses several standard approaches like univariate and multivariate regression or principal components analysis. The students are expected to understand how these methods work, how to apply them on a new dataset and to interpret the outputs of the different algorithms. Students have to submit a project in which a practical problem has to be solved using the methods studied in the course.
Evaluation	50% CC, 50% CF

Bachelor 3 - Semester 1	
Course code and title	**MATH-330 – *Measure and Integration Theory***
Instructor	Dr Omar El Dakkak – Dr Sudarshan Shinde
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The course starts with a more in-depth review of the notions seen in MATH 230 – Lebesgue Integration Theory and Complements in Probability Theory. More precisely, the course starts recalling the notion of a sigma-field and furthers the analysis of a Borel sigma-field on a topological space. Next, the notion of measure is recalled leading to the statement and proof of Caratheodory Theorem. From there, the general notion of an integral with respect to a measure is introduced and various convergence theorems recalled. In the final part of the course, signed measures, absolute continuity of a measure with respect to another and the Radon-Nikodym Theorem are presented. The course ends with a treatment of uniformly sigma-finite product measures and the Ionescu-Tulcea Theorem.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-336 – *Topology and Analysis 2***
Instructor	Dr Safaa Al Sayed
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	This aim of this course is to present some elements of Topology on metric spaces and some of their main applications in Analysis, namely on the theory of differential equations. The course starts with the definition of a metric space and of the notions of open, closed and dense subset of a metric space. Next, an introduction to Banach space (to be developed in detail in MATH 346 – Functional Analysis) is provided. Next the theory of compact metric spaces is presented, and the notions of completeness and connectedness treated in this level of generality. This part of the course ends with a detailed account on the local inversion theorem on Banach spaces and the Banach-Caccioppoli Theorem. A second part of the course will treat of the problem of the existence and unicity of a (maximal) solution of a differential equation (the Cauchy-Lipschitz Theorem).
Evaluation	50% CC, 50% CF

Course code and title	**MATH-350 – *Statistical Inference***
Instructor	Dr Omar El Dakkak – Dr Samuel Feng
Date	Sep – Dec 2025
Course format	Weekly class
Credits	12
Contact hours	120 - Total Time Commitment: 120
Course description	The course is a classical advanced course in (parametric) Mathematical Statistics. The course uses the notions and tools developed in MATH 230 – Lebesgue Integration Theory and Complements in Probability Theory and in MATH 330 – Measure and Integration Theory. It starts with a study of the Glivenko-Cantelli Theorem and its connection with the general problem of estimation. Next, order statistics are studied (in the discrete and absolutely continuous cases) and the laws of well-known statistics are derived in the gaussian case. At this stage, the general theory of point estimation is presented within which the notions of unbiasedness, consistency and optimality are studied. A particular attention is given to maximum likelihood estimation. The next topics to be treated are confidence intervals and hypothesis testing. The course ends with an account on the linear model. In the framework of the course, a series of computer labs will be run on the following topics: simulations of random variables (by inversion, rejection sampling and by the Box-Muller transform) and Monte-Carlo methods in Statistics.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-351 – *Algebra & Cryptography***
Instructor	Dr Grace Younes – Dr Sudarshan Shinde
Date	Sep – Dec 2025
Course format	Weekly class
Credits	6
Contact hours	60 - Total Time Commitment: 60
Course description	The course is divided into two parts: 1. The first part consists of an introduction to the basic algebraic structures of groups and rings. We focus on important classes of rings like integral domains, unique factorisation domains, and principle domains. We also define polynomial rings where the coefficients of the polynomials are elements from a given field. We develop results concerning the divisibility and irreducibility of polynomials. 2. In the second part, we will develop some of the important concepts of number theory including many of those used in computer science. We will first introduce the notion of the divisibility of integers will prove many important results about modular arithmetic. We will discuss prime numbers and introduce the concept of greatest common divisors and study the Euclidean algorithm for computing them. We will explain how to solve linear congruences, as well as systems of linear congruences, which we solve using the famous Chinese remainder theorem. We introduce the subject of cryptography which plays an essential role in electronic communication. We will show how the ideas we develop can be used in cryptographical protocols, introducing protocols for sharing keys and for sending signed messages.
Evaluation	50% CC, 50% CF

Bachelor 3 - Semester 2	
Course code and title	**MATH-355 – *Advanced Probability Theory***
Instructor	Dr Miklos Ruszinko
Date	Jan – May 2026
Course format	Weekly class
Credits	9
Contact hours	90 - Total Time Commitment: 90
Course description	The course follows on from the notions acquired in MATH 230 – Lebesgue Integration Theory and Complements in Probability Theory and in MATH 330 – Measure and Integration Theory. It starts by a rigorous treatment the laws of large numbers and central limit theorems for triangular arrays. After a presentation of the theory of weak convergence, the multivariate central limit theorem is examined in detail. Next, the general theory of conditional expectation (given a sigma-field) is presented with a particular focus on the notion of regular conditional probability laws. The last third of the course is devoted to the treatment of some well-known stochastic processes: Discrete-time martingales and continuous-time Gaussian and stationary processes. The course ends with an introduction to Brownian motion.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-346 – *Functional Analysis***
Instructor	Dr Safaa Al Sayed
Date	Jan – May 2026
Course format	Weekly class
Credits	9
Contact hours	90 - Total Time Commitment: 90
Course description	The course follows on ideally from MATH 330 – Measure and Integration Theory by developing standard notions of Functional Analysis. After recalling some well-known inequalities (Hölder, Minkowski, Jensen, etc.) the course properly starts with a rigorous treatment of normed vector spaces and Banach spaces. This leads to the study of L^p-spaces and various mathematical properties of such spaces (convergence, completeness, compactness, etc). The study of Hilbert spaces comes next with a particular attention to infinite-dimensional Hilbert spaces. In the last part of the course, Duality theory, convolutions and Fourier transforms on R^n.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-370 – *Data Science and Machine Learning***
Instructor	Dr Tanujit Chakraborty – Part-time Madhurima Panja
Date	Jan – May 2026
Course format	Weekly class
Credits	12
Contact hours	120 - Total Time Commitment: 120
Course description	The aim of this course is to provide students a general introduction to data science and machine learning methods. The difference between statistics, data science and machine learning may sometimes feel unclear, because some methods are common to the three disciplines. The main idea is that statistics basically concern the estimation of parameters and their interpretation, whereas data science mainly deals with description and explanation of the data and machine learning with prediction. This course presents classical algorithms of optimisation, classification and prediction. Students have to submit a project in which an industrial problem has to be solved using the methods studied in the course.
Evaluation	50% CC, 50% CF

Course code and title	**MATH-301 – *Integration to the World of Work 2***
Instructor	Part-time Dr Mai El Sawy
Date	Jan – May 2026
Course format	Weekly class
Credits	3
Contact hours	30 - Total Time Commitment: 30
Course description	In this course, students will explore their own self, career aspirations, and the world around them. They will be armed to harmoniously face a professional world that is in continuous evolution. They will reflect on their career. The course explores two aspects. The first aspect focuses on the individual, through self-assessment and learning skills such as writing a CV and presenting oneself. The second aspect focuses on global trends and their current and future impact on the individual, society and economy. More precisely, students learn how the world of work is changing. As a result, they are made aware of the nature of competencies that will be relevant in the future and how their newly acquired skillsets can be employed to foster a successful career. The specific case of physicists will be tackled along the course.
Evaluation	50% CC, 50% CF

Permanent Academic and Administrative Staff

Head of Department: Dr Valerie Le Guyon
Head of Programme: Dr Omar El Dakkak
Academic Coordinator: Patricia Chahwane
Permanent Faculty:

- Dr Eliane Bsaibess
- Dr Gianluca Mola
- Dr Grace Younes
- Dr Omar El Dakkak
- Dr Lama Tarsissi
- Dr Samuel Feng
- Dr Safaa Elsayed
- Dr Sudarshan Shinde
- Dr Tanujit Chakraborty
- Dr Miklos Ruszinko

Position	Contact Details
Head of Department	Dr Valerie Le Guyon Ext. 9283 valerie.leguyon@sorbonne.ae
Head of Programme	Dr Omar El Dakkak Ext. 9357 omar.eldakkak@sorbonne.ae
Academic Coordinator	Mrs Patricia Chahwane Ext. 9417 Patricia.chahwane@sorbonne.ae
Student Affairs Acting Head of Department	Mrs Sylva Hardan Ext. 9749 sylva.hardan@sorbonne.ae
Sports Head of Department	Mrs Ellenita Merle Ext. 9356 Ellenita.Merle@sorbonne.ae
Sports Office	sports@sorbonne.ae +971 (0) 2 656 9356
Other Services - Female Student Residence	Ext. 9395
Other Services - Male Student Residence	Ext. 9394
Medical Clinic	Ext. 9621

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The curriculum follows the European ECTS system