Course Prospectus

Postgraduate Certificate in Fundamentals of Data Science TU257

Academic Year 2024-25

Contents

Postgraduate Certificate in Fundamentals of Data Science (TU257)

On behalf of our programme team, we would like to offer some insights into the PgCert in Fundamentals of Data Science. The PgCert is a one year part time postgraduate conversion programme that aims to provide non-computing graduates an opportunity to upskill in the developing area of data analysis and data science. This is a postgraduate programme at level 9 in the National Framework of Qualifications. The programme covers the key skills needed for an entry level position in data analytics, including modules in programming, databases, data wrangling and data analysis. The delivery is very practically focussed with students developing skills in the main tools, methods and techniques used in the data science field.

This prospectus serves as a general reference for the programme. This document will offer information on the programme structures, the modules, assessment and general FAQ.

Technological University Dublin (TU Dublin) builds upon a tradition of high quality, practically focussed education that has been synonymous in Ireland over 130 years. The campus offers students in the University an opportunity to learn in a modern, state-of-the-art facility designed to create an excellent student experience. The campus is easily accessed on foot from the City Centre (10-15 minutes from O'Connell St), or via the Grangegorman Luas stop.

During the 2024-25 academic year, the programme will be delivered in a blended mode with all lecture and lab sessions running 100% online. We also offer the opportunity to attend campus on certain weeks each semester to cater for students who like to experience some classes for face-to-face learning.

If you have any questions or queries regarding our PgCert in Fundamentals of Data Science please send us a mail (school.cs@tudublin.ie)

Jonathan McCarthy (Programme Coordinator)
Lecturer - School of Computer Science
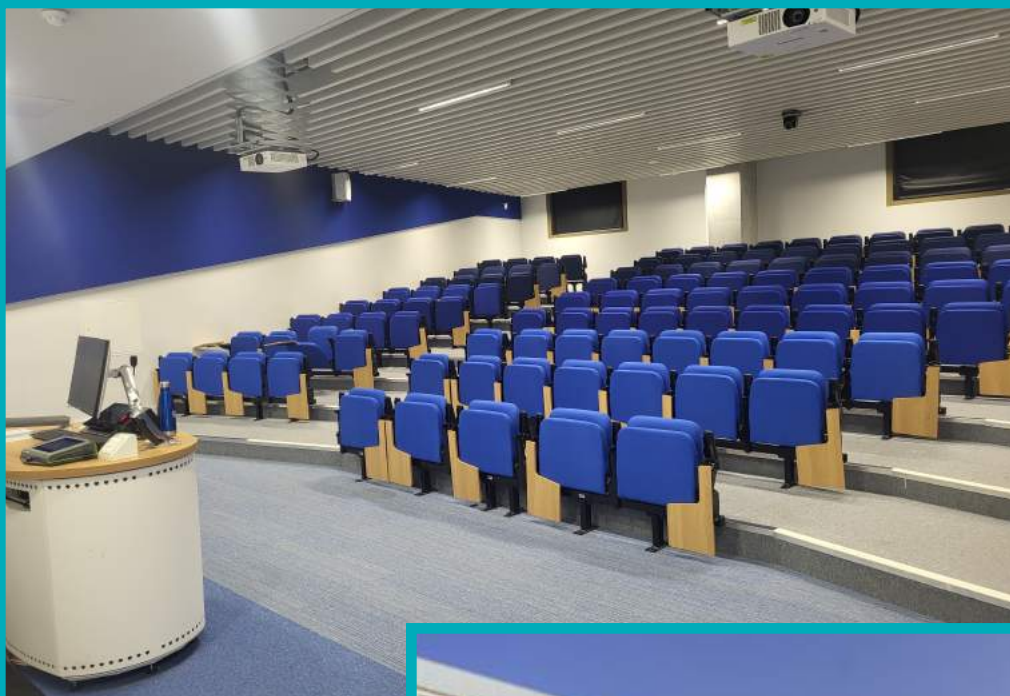
Course Information

Programme Aims/Objectives

The Postgraduate Certificate in Fundamentals in Data Science (Conversion) aims to provide non-computing graduates an opportunity to upskill in the developing area of data analysis and data science.

Students will study a set of four core computing modules in data science. It is very practically focussed with students developing skills in the principle technologies, methods and techniques used in the domain of data science. Our goal is to prepare students for a new career path in data science or for progression onto the PG Cert in Data Science.

As this is a blended course delivery the assessment strategy will be 100% continuous assessment. This will take place on an ongoing basis throughout the year, through lab work, assignments and reports.

On completion of this programme the graduate will be able to:

- Demonstrate knowledge and understanding of the fundamental technologies of data science including programming, data wrangling, databases and data analysis.
- Perform data analysis on different types of data types, both structured and unstructured and from a variety of different data sources.
- Identify, perform and evaluate appropriate data analytics solutions to business problems.
- Design and implement database systems using appropriate methods and technologies.
- Participate as a data analyst on data oriented projects in industry
- Work effectively as an individual and as a member of a data driven project team.
- Demonstrate an awareness of the resources available to keep up to date with new developments in the field.

Course modules:

Semester 1	Semester 2
OOSD	Data Wrangling
Information Systems	Data Analytics

Career Conversion Courses

What is a postgraduate conversion course?

A postgraduate conversion course facilitates graduates to convert to a new discipline. This enables graduates of one discipline to acquire a qualification in a different discipline at Postgraduate Certificate and Masters Level. Having studied a particular degree you may decide that you wish to change your career path and consider undertaking a conversion programme at TU Dublin.

In the School of Computer Science we have two career conversion course offerings. This will offer you the opportunity to acquire new skills that are in demand in the IT industry. Each person will always have their own specific path and goals and the conversion courses can be a major facilitator in achieving this.

One key piece of a conversion course is combining your existing skills and experiences gained from your previous work and studies. These transferable skills are very relevant and can be applied a variety of new roles. Combined skillsets are very desirable to employers as it offers skills in a number of different areas.

Career conversion courses offer several benefits to individuals looking to transition into a new field or industry. To facilitate a move into the disciplines of Computer Science and/or Data Science the School of Computer Science has two tailored conversion course offerings:

Part-Time: TU257 - Fundamentals of Data Science
Full-Time: TU259 - Computing (Fundamentals of) Masters Qualifier

Module Content

Object Oriented Software Development

This module provides the learner with the fundamental skills of programming and object oriented programming. The module is currently taught using the Python programming language.

The aims of this module are:
- To provide the learner with strong fundamental programming skills.
- To provide the learner with object-oriented programming skills.
- To ensure the learner has the necessary skills to design and develop an application using an object-oriented language.

Learning Outcomes:
1. Design an object-oriented software application.
2. Implement a software application using an object-oriented programming language utilising core object-oriented programming concepts, and develop problem solving skills as part of this process.
3. Test and debug an object-oriented software application.
4. Implement basic algorithms and data structures using an object-oriented programming language.
5. Select and evaluate appropriate methods, including algorithms and patterns, for the implementation of object-oriented solutions.

Indicative Syllabus:
Fundamentals of Programming:
- Types, variables and operators, Control structures, Code style and quality

Object Oriented Programming:
- Objects and classes, Methods, Inheritance and polymorphism, Exception handing

Data Structures and Algorithms:
- Collections, Data structures and algorithms e.g. (1D and 2D arrays, SLL, Queue, Stack), Analysis of algorithms

Information Systems

Information Systems

This module provides the learner with fundamental skills to design information systems, focussing on the design and implementation of database systems.

The aims of this module are:
- Enable the student to create new relational databases by devising a high-level conceptual data model.
- Transform that data model into a relational schema.
- Implement the relational schema correctly and robustly in SQL.

Learning Outcomes:
1. Design and evaluate a relational database schema for a software application.
2. Devise and implement a set of relational tables and develop the relational database.
3. Query a relational database using SQL.
4. Evaluate the use of relational and non-relational data storage technologies.

Indicative Syllabus:
Relational Database Design:
- ER diagrams and mapping to a relational schema, Data normalisation, Relational integrity, Keys, Indexes, Database transactions, ACID properties

SQL:
- Schema definition and data manipulation in SQL, SQL queries, Introduction to stored procedures

Non-relational storage:
- Schema-less storage (no SQL), XML and XML Schema

Data Analytics

The aims of this module are:
Data analytics is an area of increasing importance and interest to organisations. Data analytics techniques offer huge potential in the creation of new knowledge products and services and the enhancement of existing products and services. Rather than focus on the details of specific data analytics techniques, this module addresses the application of data analytics techniques (from simple descriptive analytics techniques to more complex predictive analytics techniques) to real business problems.

Learning Outcomes:
1. Discuss the role of data analytics in an organisation.
2. Develop appropriate data analytics solutions to business problems.
3. Discuss the role of data management in data analytics and associated legal and ethical issues.
4. Evaluate the range of different data analytics techniques and their data requirements.
5. Analyse and evaluate the suitability of different data analytics techniques.
6. Analyse case studies on how data analytics is used in different organisations.
7. Perform data analytics tasks.

Indicative Syllabus:
Introduction to data mining and applications of data analytics:
- (Data, Information, Knowledge), Modelling an activity, Framing a business model, Developing a model, Deploying a model, Communicating results, Case studies

Data Analytics Life Cycle:
- Stages of a data analytics project, Outputs of each stage, Roles and responsibilities of people involved in data analytics

Data Management:
- Introduction to Data Management, Role of organisations and stakeholders, Data governance and data security, Meta-data management

Data Analytics Techniques:
- Predictive modelling techniques (e.g. regression, nearest neighbour, decision trees, neural networks, support vector machines), Pattern discovery (e.g. association rule mining, clustering algorithms), Evaluation of data analysis techniques, Visualisation of data insight results, Legal & ethical issues in data analytics

Tools:
- Data analysis tools, Data modelling tools

Data Wrangling

The aims of this module are:
The Data Wrangling module provides students with an opportunity to learn the skills and techniques most often associated with building and manipulating information sources to perform Data Analysis tasks. The module is intended to build a student's skills and confidence with Data Programming tasks and provide a firm foundation for further Data Analytics study.

Learning Outcomes:
1. Use a data programming language to manipulate frame-style and pure matrix-style data.
2. Use common APIs to source data from proprietary and open sources.
3. Programmatically merge data from multiple source types (spreadsheets and APIs).
4. Evaluate the strengths and weaknesses of a number of alternative data storage mechanisms.
5. Apply methods for cleansing and normalising data and combining/integrating data from multiple sources.

Indicative Syllabus:
- Data Types – structured versus unstructured, numeric versus categorical
- Data Programming Languages – common features. Frames, Matrix Manipulation, Graphics Libraries
- Data Programming Languages II – Reading and Writing Common Data Types to File
- Data Selection: Indices versus Named Access
- Data Processing Operations: Applying functions to subsets of a Data Table
- APIs for Data Access. Twitter API, Reddit API, Accessing APIs in Data Programming Languages
- Data Storage Types: Spreadsheet Files, Relational Databases, NoSQL Databases
- Retrieving and Storing API Data for Future Analysis
- Data Quality – Common Quality concerns with Data. Missing Data. Inaccurate Data.
- Data Cleansing Methods – Dropping Rows, Interpolating Values
- Data Normalisation: Z-Score Normalisation vs Min-Max Normalisation
- Integrating Heterogeneous Data Sets

Springboard

Springboard Funding

The TU257 course is available for Springboard funding (subject to approval for 2024-2025).

The Springboard+ upskilling initiative offers free and subsidised courses at certificate, degree and masters level leading to qualifications in areas where there are employment opportunities in the economy.
Springboard+ courses are available to the unemployed, returners (formerly homemakers), formerly self-employed, the employed and recent graduates. Most of the courses are offered on a part-time basis for a maximum of 12 months and are open to all eligible applicants regardless of their employment status.

For further information on eligibility and details on how to apply visit www.springboardcourses.ie

Entry Requirements

Minimum Entry Requirements

The minimum admission requirements for entry to the PgCert in Fundamentals of Data Science are a 2.1 classification level 8 degree in a non-computing related degree or a 2.2 classification level 8 degree with at least 2 years of relevant industry experience.

All applicants arerequired to have demonstrated strong numeracy and analytic skills which should be described in your supporting statement.

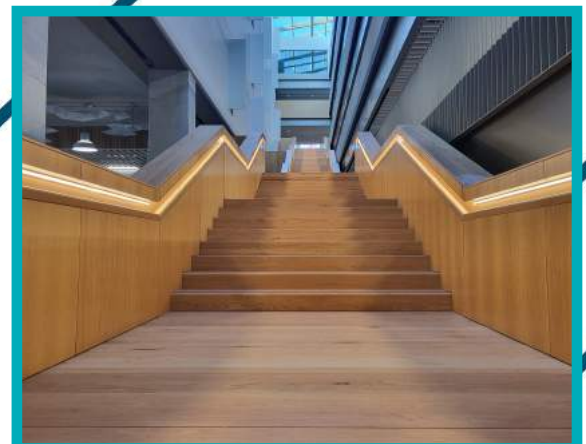## Can I progress to the Masters programmes at TU Dublin?

Graduates of the PgCert in Fundamentals of Data Science can apply for the PgCert in Data Science TU256 (funded by Springboard) or the MSc in Data Science (TU059/TU060). Progression is subject to passing all modules, performing well on the programming (OOSD) module and achieving an overall average of 60% or higher.

Postgraduate Certificate in Data Science (TU256)
https://www.tudublin.ie/study/postgraduate/courses/data-science/

MSc in Data Science (part time and full time)
https://www.tudublin.ie/study/postgraduate/courses/computing-data-science2/

Frequently Asked Questions

Are classes online?

The TU257 course is offered as a blended delivery. Classes are delivered 100% online. All lecture sessions are recorded to help students catch up with material if they are not able to attend some classes.

What is a Conversion Programme?

A conversion programme enables graduates of one discipline to acquire a qualification in a different discipline at Postgraduate Certificate and Masters Level. Having studied a particular degree you may decide that you wish to change your career path and consider undertaking a conversion programme at TU Dublin.

I don't meet the minimum entry requirements, what are my options?

Applications may be considered based on relevant work experience plus previous education. Contact the programme coordinator (school.cs@tudublin.ie) to discuss the application process.

Who can I contact if I have more questions regarding the course?

If you have any specific questions regarding the TU257 course please email school.cs@tudublin.ie

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Course Information

When are classes on?

Classes are held two evenings a week and will be start at 6pm. The following is the provisional schedule (subject to approval):

Semester 1:

OOSD	Mondays 6pm to 10pm
Information Systems	Wednesdays 6.30pm to 9.30pm

Semester 2:

Data Analytics	Mondays 6pm to 10pm
Data Wrangling	Thursdays 6.30pm to 9.30pm

When does the course start?

Classes will start on Monday 16th September.

Are there any written exams?

As the course delivery is 100% online there are no in-person written exams. The assessment strategy will be continuous assessment. This will be a variety of submissions / quizzes / projects.

Is there a large time commitment in taking a course?

A general rule for taking a course is for every hour of lecture/lab you may need to spend an additional two to three hours of independent study / work. This includes completing weekly practical work, reviewing lecture notes and completing assignments.

Where can I get more information?

For more information please visit the TU Dublin website or email school.cs@tudublin.ie

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