

Course Catalog

2023 – 2024

Master of Science in Data Science and Artificial Intelligence Courses

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European Business University of Luxembourg

Wiltz Campus | Online Campus

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INTRODUCTION

This catalog provides course syllabi for all Master of Science in Data Science and Artificial Intelligence (MSDA) graduate courses. Unless mentioned otherwise, course structure, as well as course evaluation are standardized for all undergraduate courses. Credits are expressed using the European Credit Transfer System. One European credit stands for 30 hours of workload, consisting of 10 contact hours and 20 study hours. Contact hours include lectures, discussion forums and examinations and study hours include independent study, practical work, research, etc.

One graduate semester consists of 10 weeks of class sessions and exam sessions.

COURSE PLANNING

The total number of courses offered is dependent on the total credit study plan requirements of enrolled students. Students plan their courses according to course availability and prerequisites. Some of the courses have required prerequisites.

A minimum of one course from each of the graduate specialization courses is offered. The total number of specialization courses offered per specialization is dependent on the total credit and course requirements of enrolled students. Students plan their courses according to course availability. None of the specialization courses have required prerequisites.

COURSE SCHEDULING

Courses are scheduled over the full duration of the semester and all courses finish within one semester. Graduate courses consist of 39 contact hours, 1-2 midterm exam hours and 2 final exam hours. Contact hours are usually scheduled as 15 hours (1.5) class sessions with one session per week for the duration of the semester and 2 hours of discussion forum per week for 10 weeks. Mid term exams take place in week 5 and final exams take place in week 10 of each semester.

COURSE STRUCTURE

Students are provided a strong theoretical foundation and are introduced to the various concepts in order to gain a thorough understanding of the subject matter. The practical application and implementation of these specific concepts are methodically discussed during the various class sessions by means of real-life examples and comprehensive case studies.

COURSE CONTENT AND LEARNING OUTCOMES

All courses are graduate level and are taught according to a student centered approach. Course content listed should be regarded as indicative course content. Learning outcomes listed are reference points and should be regarded as intended learning outcomes for what students are expected to be able to do at the end of the course. Assessments done in the course should address these learning outcomes. The learning outcomes are established according to Benjamin Bloom's taxonomy for cognitive learning. Based on this framework, courses at Graduate level address primarily the thinking processes: Knowledge,

Comprehension, Application, and Analysis.

The overall learning of the courses at the graduate program corresponds to the level descriptors of the European Qualifications Framework (EQF) for second cycle qualification. The overall learning of the undergraduate programs aims at students obtaining a level according to the indications below.

The descriptor for the second cycle in the Framework for Qualifications of the European Higher Education Area agreed by the ministers responsible for higher education at their meeting in Bergen in May 2005 in the framework of the Bologna process corresponds to the learning outcomes for EQF level 7.

SETTING

- Operational Context: The learner operates in complex and unpredictable contexts, requiring selection and application from a wide range of largely standard techniques and information sources.
- Autonomy and responsibility for actions: The learner acts with minimal supervision or direction, within agreed guidelines taking responsibility for accessing support and accepts accountability for determining and achieving personal and/or group outcomes.

CHARACTERISTIC 1: KNOWLEDGE AND UNDERSTANDING

- Demonstrate and/or work with:
- Knowledge that covers and integrates most, if not all, of the main areas of the subject/discipline/sector – including their features, boundaries, terminology
- and conventions.
- A critical understanding of the principal theories, concepts and principles.
- A critical understanding of a range of specialised theories, concepts and principles.
- Extensive, detailed and critical knowledge and understanding in one or more specialisms, much of which is at, or informed by, developments at the forefront.
- A critical awareness of current issues in a subject/discipline/sector and one or more specialisms.

CHARACTERISTIC 2: PRACTICE: APPLIED KNOWLEDGE, SKILLS AND UNDERSTANDING

- Apply knowledge, skills and understanding:
- In using a significant range of the principal professional skills, techniques, practices and/or materials associated with the subject/discipline/sector.
- In using a range of specialised skills, techniques, practices and/or materials that are at the forefront of, or informed by forefront developments.
- In applying a range of standard and specialised research and/or equivalent instruments and techniques of enquiry.
- In planning and executing a significant project of research, investigation or development.
- In demonstrating originality and/or creativity, including in practices.
- To practise in a wide and often unpredictable variety of professional level contexts.

CHARACTERISTIC 3: GENERIC COGNITIVE SKILLS

- Apply critical analysis, evaluation and synthesis to forefront issues, or issues that are informed by forefront developments in the subject/discipline/sector.
- Identify, conceptualise and define new and abstract problems and issues.
- Develop original and creative responses to problems and issues.
- Critically review, consolidate and extend knowledge, skills, practices and thinking in a subject/discipline/sector.
- Deal with complex issues and make informed judgements in situations in the absence of complete or consistent data/information.

CHARACTERISTIC 4: COMMUNICATION, ICT AND NUMERACY SKILLS

- Use a wide range of routine skills and a range of advanced and specialised skills as appropriate to a subject/discipline/sector, for example:
- Communicate, using appropriate methods, to a range of audiences with different levels of knowledge/expertise.
- Communicate with peers, more senior colleagues and specialists.
- Use a wide range of ICT applications to support and enhance work at this level and adjust features to suit purpose.
- Undertake critical evaluations of a wide range of numerical and graphical data.

CHARACTERISTIC 5: AUTONOMY, ACCOUNTABILITY AND WORKING WITH OTHERS

- Exercise substantial autonomy and initiative in professional and equivalent activities.
- Take responsibility for your own work and/or significant responsibility for the work of others.
- Take significant responsibility for a range of resources.
- Work in a peer relationship with specialist practitioners.
- Demonstrate leadership and/or initiative and make an identifiable contribution to change and development and/or new thinking.
- Practise in ways which draw on critical reflection on your own and others' roles and responsibilities.
- Manage complex ethical and professional issues and make informed judgements on issues not addressed by current professional and/or ethical codes or practices.

COURSE EVALUATION

Course evaluation: Study Load per 4 ECTS course	Total 113 hrs.
- Lectures: one hour and a half per week for (10 weeks)	15 hours
- Self-directed content learning & preparation: 4 hours per week (10 weeks)	40 hours
- Formative Assessments/Research assignments	36 hours
- Course Preparation and Discussion Forums: 2 hours per week for 10 Weeks	20 hours
- Written Summative Assessments	2 hours

Attendance to all class sessions and participation in all class discussions is mandatory and is part of the final grade for the course. Reading materials and discussion questions should be prepared by each student individually by the next class session. There should be graded weekly assignments. Formative assignments, where feedback is provided on the student's performance but the grade not included in the final grade, are also given throughout the course. Credits are only awarded upon successful completion of the entire course. Partial credit for partial completion of a course is not awarded.

We reserve the right to change the content of this catalog and to make changes to the academic curriculum at any time and without prior notice.

CORE COURSE

CODE: MSDA100 - DATA SCIENCE IN REAL LIFE

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Data Science is the highly sought field of the century. Explore the truth about what Data Science is and hear from real practitioners telling real stories about what it means to work in Data Science and use cases for the same.

LEARNING OBJECTIVES:

- Gain fundamental knowledge of what is Data Science and what do Data Science people do
- Learn about Data Science in a business context and what is the future of Data Science
- Understand Data Science applications and discover some use cases for Data Science

CONTENT

Lesson 1 - Defining Data Science

Lesson 2 - What Does a Data Science Professional Do?

Lesson 3 - Data Science in Business

Lesson 4 - Use Cases for Data Science

Lesson 5 - Data Science People

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Gain fundamental knowledge of what is Data Science and what do Data Science people do	No	x	x		
L2	Learn about Data Science in a business context and what is the future of Data Science	YES	x	x		

L3	Understand Data Science applications and discover some use cases for Data Science	YES	x	x	x	x
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A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≈ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA101 - STATISTICS ESSENTIALS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Recommended	Mathematics - Statistics and Probability
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Statistics is the science of assigning a probability to an event based on experiments. It is the application of quantitative principles to the collection, analysis, and presentation of numerical data. Students will learn the fundamentals of Data Science, statistics, and Machine Learning with this course. It will enable students to define statistics and essential terms related to it, explain measures of central tendency and dispersion, and comprehend skewness, correlation, regression, distribution.

Students will be able to make data-driven predictions through statistical inference.

LEARNING OBJECTIVES

- Understand the fundamentals of statistics
- Work with different types of data
- How to plot different types of data
- Calculate the measures of central tendency, asymmetry, and variability
- Calculate correlation and covariance
- Distinguish and work with different types of distribution
- Estimate confidence intervals
- Perform hypothesis testing
- Make data-driven decisions
- Understand the mechanics of regression analysis
- Carry out regression analysis
- Use and understand dummy variables
- Understand the concepts needed for data science even with Python and R

CONTENT

Lesson 1 - Introduction

Lesson 2 - Sample or Population Data?

Lesson 3 - The Fundamentals of Descriptive Statistics

Lesson 4 - Measures of Central Tendency, Asymmetry, and Variability

Lesson 5 - Practical Example: Descriptive Statistics

Lesson 6 - Distributions

Lesson 7 - Estimators and Estimates

Lesson 8 - Confidence Intervals: Advanced Topics

Lesson 9 - Practical Example: Inferential Statistics

Lesson 10 - Hypothesis Testing: Introduction Lesson

11 - Hypothesis Testing: Let's Start Testing!

Lesson 12 - Practical Example: Hypothesis Testing

Lesson 13 - The Fundamentals of Regression Analysis

Lesson 14 - Subtleties of Regression Analysis

Lesson 15 - Assumptions for Linear Regression Analysis

Lesson 16 - Dealing with Categorical Data

Lesson 17 - Practical Example: Regression Analysis

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Understand the fundamentals of statistics, work with different types of data and Learn how to plot different types of data	YES	X	X	X	X
L2	Calculate the measures of central tendency, asymmetry, and variability Calculate correlation and covariance Distinguish and work with different types of distribution	YES	X	X	X	X
L3	Estimate confidence intervals Perform hypothesis testing Make data-driven decisions	YES	X	X	X	X
L4	Understand the mechanics of regression analysis and carry out regression analysis	YES	X	X	X	X
L5	Use and understand dummy variables Understand the concepts needed for data science even with Python and R	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: \geq 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA102 - INTRODUCTION TO ARTIFICIAL INTELLIGENCE

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Introduction to Artificial Intelligence course is designed to help learners decode the mystery of Artificial Intelligence and understand its business applications. The course provides an overview of Artificial Intelligence concepts and workflows, Machine Learning, Deep Learning, and performance metrics.

Students learn the difference between supervised, unsupervised, and reinforcement learning-be exposed to use cases, and see how clustering and classification algorithms help identify Artificial Intelligence business applications.

LEARNING OBJECTIVES:

- Meaning, purpose, scope, stages, applications, and effects of Artificial Intelligence
- Fundamental concepts of Machine Learning and Deep Learning
- Difference between supervised, semi-supervised and unsupervised learning
- Machine Learning workflow and how to implement the steps effectively
- The role of performance metrics and how to identify their essential methods

CONTENT

Lesson 1 - Decoding Artificial Intelligence

Lesson 2 - Fundamentals of Machine Learning and Deep Learning

Lesson 3 - Machine Learning Workflow

Lesson 4 - Performance Metrics

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Meaning, purpose, scope, stages, applications, and effects of Artificial Intelligence	YES	x	x	x	x
L2	Fundamental concepts of Machine Learning and Deep Learning	YES	x	x	x	x

L3	Difference between supervised, semi-supervised and unsupervised learning	YES	x	x	x	x
L4	Machine Learning workflow and how to implement the steps effectively	YES	x	x	x	x
L5	The role of performance metrics and how to identify their essential methods	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA103 - DATA SCIENCE WITH R

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Recommended	Mathematics - Statistics and Probability
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Students will learn the major step to a data scientist being learning R - the upcoming and most in-demand open source technology. R is an extremely powerful Data Science and analytics language which has a steep learning curve and a very vibrant community. This is why it is quickly becoming the technology of choice for organizations who are adopting the power of analytics for competitive advantage

LEARNING OBJECTIVES:

- Gain a foundational understanding of business analytics
- Install R, R-studio, and workspace setup, and learn about the various R packages
- Master R programming and understand how various statements are executed in R
- Gain an in-depth understanding of data structure used in R and learn to import/export data in R
- Define, understand and use the various apply functions and DPYR functions
- Understand and use the various graphics in R for data visualization Gain a basic understanding of various statistical concepts
- Understand and use hypothesis testing method to drive business decisions
- Understand and use linear, non-linear regression models, and classification techniques for data analysis
- Learn and use the various association rules and Apriori algorithm
- Learn and use clustering methods including K-means, DBSCAN, and hierarchical clustering

CONTENT

Lesson 1 - Introduction to Business Analytics

Lesson 2 - Introduction to R Programming

Lesson 3 - Data Structures

Lesson 4 - Data Visualization

Lesson 5 - Statistics for Data Science I

Lesson 6 - Statistics for Data Science II

Lesson 7 - Regression Analysis

Lesson 8 - Classification

Lesson 9 - Clustering

Lesson 10 - Association

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Gain a foundational understanding of business analytics Install R, R-studio, and workspace setup, and learn about the various R packages	YES	x	x	x	x
L2	Master R programming and understand how various statements are executed in R Gain an in-depth understanding of data structure used in R and learn to import/export data in R	YES	x	x	x	x
L3	Define, understand and use the various apply functions and DPYR functions	YES	x	x	x	x
L4	Understand and use the various graphics in R for data visualization Gain a basic understanding of various statistical concepts	YES	x	x	x	x
L5	Understand and use hypothesis testing method to drive business decisions	YES	x	x	x	x
L6	Understand and use linear, non-linear regression models, and classification techniques for data analysis	YES	x	x	x	x
L7	Learn and use the various association rules and Apriori algorithm	YES	x	x	x	x
L8	Learn and use clustering methods including K-means, DBSCAN, and hierarchical clustering	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA104 - PYTHON FOR DATA SCIENCE

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Recommended	Intermediate Python Programming Course
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Students will review Python for Data Science with this introductory course and familiarize themselves with programming. Carefully crafted by EBU, upon completion of this course students will be able to write Python scripts, perform fundamental hands-on data analysis using the Jupyter- based lab environment, and create their own Data Science projects.

LEARNING OBJECTIVES:

- Write a Python program by implementing concepts of variables, strings, functions, loops, conditions
- Understand the nuances of lists, sets, dictionaries, conditions and branching, objects and classes
- Work with data in Python such as reading and writing files, loading, working, and saving data with Pandas

CONTENT

Lesson 1 - Python Basics

Lesson 2 - Python Data Structures

Lesson 3 - Python Programming Fundamentals

Lesson 4 - Working with Data in Python

Lesson 5 - Working with NumPy arrays

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Write a Python program by implementing concepts of variables, strings, functions, loops, conditions	YES	x	x	x	x
L2	Understand the nuances of lists, sets, dictionaries, conditions and branching, objects and classes	YES	x	x	x	x
L3	Work with data in Python such as reading and writing files, loading, working, and saving data with Pandas	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA200 - DATA SCIENCE WITH PYTHON

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Recommended	MSDA104 PYTHON FOR DATA SCIENCE (4 ECTS)
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This Data Science with Python course will establish student mastery of Data Science and analytics techniques using Python. With this Python for Data Science Course, students learn the essential concepts of Python programming and gain in-depth knowledge in data analytics, Machine Learning, data visualization, web scraping, and natural language processing. Python is a required skill for many Data Science positions, so this is an essential interactive, hands-on course.

LEARNING OBJECTIVES:

- Gain an in-depth understanding of Data Science processes, data wrangling, data exploration, data visualization, hypothesis building, and testing. You will also learn the basics of statistics
- Install the required Python environment and other auxiliary tools and libraries
- Understand the essential concepts of Python programming such as data types, tuples, lists, dicts, basic operators and functions
- Perform high-level mathematical computing using the NumPy package and its vast library of mathematical functions
- Perform scientific and technical computing using the SciPy package and its sub-packages such as Integrate, Optimize, Statistics, IO, and Weave
- Perform data analysis and manipulation using data structures and tools provided in the Pandas package
- Gain expertise in Machine Learning using the Scikit-Learn package
- Gain an in-depth understanding of supervised learning and unsupervised learning models

such as linear regression, logistic regression, clustering, dimensionality reduction, K-NN and pipeline

- Use the Scikit-Learn package for natural language processing Use the matplotlib library of Python for data visualization
- Extract useful data from websites by performing web scraping using Python
- Integrate Python with Hadoop, Spark, and MapReduce

CONTENT

Lesson 1 - Data Science Overview

Lesson 2: Data Analytics Overview

Lesson 3: Statistical Analysis and Business Applications

Lesson 4: Python Environment Setup and Essentials Lesson

5: Mathematical Computing with Python (NumPy) Lesson 6 -

Scientific computing with Python (Scipy) Lesson 7 - Data Manipulation with Pandas

Lesson 8 - Machine Learning with Scikit-Learn

Lesson 9 - Natural Language Processing with Scikit Learn

Lesson 10 - Data Visualization in Python using matplotlib. Visualize data in python using matplotlib and plot them.

Lesson 11 - Web Scraping with BeautifulSoup

Lesson 12 - Python integration with Hadoop MapReduce and Spark

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Gain an in-depth understanding of Data Science processes, data wrangling, data exploration, data visualization, hypothesis building, and testing.	YES	x	x	x	x
L2	Install the required Python environment and other auxiliary tools and libraries, Understand the essential concepts of Python programming such as data types, tuples, lists, dicts, basic operators and functions	YES	x	x	x	x
L3	Perform high-level mathematical computing using the NumPy package and its vast library of mathematical functions	YES	x	x	x	x
L4	Perform scientific and technical computing using the SciPy package and its sub-packages such as Integrate, Optimize, Statistics, IO, and Weave	YES	x	x	x	x
L5	Perform data analysis and manipulation using data structures and tools provided in the Pandas package	YES	x	x	x	x
L6	Gain expertise in Machine Learning using the Scikit-Learn package Gain an in-depth understanding of supervised learning and unsupervised learning models such as linear regression, logistic regression, clustering, dimensionality reduction, K-NN and pipeline	YES	x	x	x	x
L7	Use the Scikit-Learn package for natural language processing Use the matplotlib library of Python for data visualization	YES	x	x	x	x

L8	Extract useful data from websites by performing web scraping using Python Integrate Python with Hadoop, Spark, and MapReduce	YES	x	x	x	x
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A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA201 - MACHINE LEARNING

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Recommended	MSDA104 PYTHON FOR DATA SCIENCE (4 ECTS) Mathematics - Statistics and Probability
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This Machine Learning course examines automation of data analysis to enable computers to learn and adapt through experience to do specific tasks without explicit programming. Students will master Machine Learning concepts and techniques, including supervised and unsupervised learning, mathematical and heuristic aspects, and hands-on modeling to develop algorithms and prepare students for their role with advanced Machine Learning knowledge.

LEARNING OBJECTIVES:

- Master the concepts of supervised and unsupervised learning, recommendation engine, and time series modeling
- Gain practical mastery over principles, algorithms, and applications of Machine Learning through a hands-on approach that includes working on four major end-to-end projects and 25+ hands-on exercises
- Acquire thorough knowledge of the statistical and heuristic aspects of Machine Learning
- Implement models such as support vector machines, kernel SVM, naive Bayes, decision tree classifier, random forest classifier, logistic regression, K-means clustering and more in Python
- Validate Machine Learning models and decode various accuracy metrics. Improve the final models using another set of optimization algorithms, which include Boosting and Bagging techniques
- Comprehend the theoretical concepts and how they relate to the practical aspects of Machine Learning

COURSE CONTENT

Lesson 1: Introduction to Artificial Intelligence and Machine Learning

Lesson 2: Data Preprocessing

Lesson 3: Supervised Learning

Lesson 4: Feature Engineering

Lesson 5: Supervised Learning-Classification

Lesson 6: Unsupervised Learning

Lesson 7: Time Series Modelling

Lesson 8: Ensemble Learning

Lesson 9: Recommender Systems

Lesson 10: Text Mining

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Master the concepts of supervised and unsupervised learning, recommendation engine, and time series modeling	YES	x	x	x	x
L2	Gain practical mastery over principles, algorithms, and applications of Machine Learning through a hands-on approach that includes working on four major end-to-end projects and 25+ hands-on exercises	YES	x	x	x	x
L3	Acquire thorough knowledge of the statistical and heuristic aspects of Machine Learning	YES	x	x	x	x
L4	Implement models such as support vector machines, kernel SVM, naive Bayes, decision tree classifier, random forest classifier, logistic regression, K-means clustering and more in Python					
L5	Validate Machine Learning models and decode various accuracy metrics. Improve the final models using another set of optimization algorithms, which include Boosting and Bagging techniques	YES	x	x	x	x
L6	Comprehend the theoretical concepts and how they relate to the practical aspects of Machine Learning	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA202 - TABLEAU DESKTOP 10

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Tableau Desktop 10 training will help students master the various aspects of the program and gain skills such as building visualization, organizing data, and designing dashboards. Students will also learn concepts of statistics, mapping, and data connection. It is an essential asset to those wishing to succeed in Data Science.

LEARNING OBJECTIVES:

- Grasp the concepts of Tableau Desktop 10, become proficient with statistics and build interactive dashboards
- Master data sources and data blending, create data extracts and organize and format data
- Master arithmetic, logical, table and LOD calculations and ad-hoc analytics
- Become an expert on visualization techniques such as heat map, tree map, waterfall, Pareto, Gantt chart and market basket analysis
- Learn to analyze data using Tableau Desktop as well as clustering and forecasting techniques
- Gain command of mapping concepts such as custom geocoding and radial selections
- Master Special Field Types and Tableau Generated Fields and the process of creating and using parameters
- Learn how to build interactive dashboards, story interfaces and how to share your work

CONTENT

Lesson 1 - Getting Started with Tableau

Lesson 2 - Working with Tableau

Lesson 3 - Deep diving with Data and Connections

Lesson 4 - Creating Charts

Lesson 5 - Adding Calculations to your workbook

Lesson 6 - Mapping Data in Tableau

Lesson 7 - Dashboards and Stories Lesson 8

- Visualizations for an Audience

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Grasp the concepts of Tableau Desktop 10, become proficient with statistics and build interactive dashboards	YES	x	x	x	x
L2	Master data sources and data blending, create data extracts and organize and format data	YES	x	x	x	x
L3	Master arithmetic, logical, table and LOD calculations and ad-hoc analytics	YES	x	x	x	x
L4	Become an expert on visualization techniques such as heat map, tree map, waterfall, Pareto, Gantt chart and market basket analysis	YES	x	x	x	x
L5	Learn to analyze data using Tableau Desktop as well as clustering and forecasting techniques	YES	x	x	x	x
L6	Gain command of mapping concepts such as custom geocoding and radial selections	YES	x	x	x	x
L7	Master Special Field Types and Tableau Generated Fields and the process of creating and using parameters	YES	x	x	x	x
L8	Learn how to build interactive dashboards, story interfaces and how to share your work	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA203 - DATA HADOOP & SPARK DEVELOPER

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Recommended	MSDA101 STATISTICS ESSENTIAL (4 ECTS)
Co-requisites	MSDA104 PYTHON FOR DATA SCIENCE (4 ECTS)
Prohibited Combinations	N/A

COURSE OVERVIEW

This Big Data Hadoop Training Course helps students master Big Data and Hadoop Ecosystem tools, such as HDFS, YARN, MapReduce, Hive, Pig, HBase, Spark, Flume, Hadoop Frameworks, and additional concepts of Big Data processing life cycle. Throughout this online instructor-led Hadoop Training, students will gain an understanding of how the different components in the eco system come together to enable data ingestion, processing and analysis.

LEARNING OBJECTIVES:

- Learn how to navigate the Hadoop Ecosystem
- Understand Hadoop cluster architecture and various operations
- Ingest real time data using Flume
- Implement partitioning, bucketing, and indexing in Hive
- Work with RDD in Apache Spark

CONTENT

Lesson 1- Introduction to Big Data and Hadoop

Lesson 2 – Introduction to different components of Hadoop Ecosystem

Lesson 3 - Hadoop Cluster Architecture – HDFS and HDFS Operations

Lesson 4 - MapReduce Framework Lesson 5 - Hadoop YARN

Lesson 6 - Hadoop Ecosystems - Hive Lesson 7 - Hadoop Ecosystems – Pig Lesson 8 - Hadoop Flume – Streaming Data Ingestion using Flume

Lesson 9 - Introduction to Apache Spark, RDD

Lesson 10 - Data sharing using Spark RD

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Learn how to navigate the Hadoop Ecosystem and understand how to optimize its use	YES	x	x	x	x
L2	Perform DataFrame operations in Spark using HIVE SQL	YES	x	x	x	x
L3	Implement partitioning, bucketing, and indexing in Hive	YES	x	x	x	x
L4	Streaming Data Ingestion using Flume	YES	x	x	x	x
L5	Work with RDD in Apache Spark	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Hadoop – The Definitive Guide by Tom White, O’Reilly Publications
- Hadoop Operations by Eric Sammers, O’Reilly Publications

CORE COURSE

CODE: MSDA204 - DATA SCIENCE CAPSTONE PROJECT

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: N/A

Total contact hours: N/A

Total exam hours: N/A

Total study hours: Self-directed Research 76hrs

Language of instruction: English

Pre-requisites	Completion of Term I, II and III courses
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This Data Science Capstone project will give students an opportunity to implement the skills learned throughout this Program by putting into practice the knowledge and skills they have learned during their coursework. Students will learn how to solve a real-world, industry-aligned Data Science problem, from data processing and model building and showcase business results and insights. The project is one of the final steps in the Program.

Students will continue this Capstone independently. This is therefore an opportunity to independently develop and implement a data science solution and explore potential employment partnerships. Students should showcase their expertise in Data Science to future or current employers.

LEARNING OBJECTIVES:

- The Problem / Challenge; Describe the problem or challenge to be addressed in the project. Include the context of the problem such as the organization, locality, industry etc.
- Data Acquisition; Describe the source and method used to acquire the data for the project
- Data Processing; In this step, students will apply various data processing techniques to make raw data meaningful. Students must subscribe to SQL coding resource <https://www.blazesql.com>
- Model Building and Fitting - This will be performed using Machine Learning algorithms like regression, multinomial Naïve Bayes, SVM, tree-based algorithms, etc.
- Unsupervised Learning - Clustering to group similar kind of transactions/reviews using NLP and related techniques to devise meaningful conclusions.
- Model Deployment - Deploy the model and demonstrate its working in a real-world scenario.
- Results - are to be submitted in the Submission Area for final evaluation as per the rubric guidelines

CONTENT

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Data Processing - In this step, students will apply various data processing techniques to make raw data meaningful.	YES	x	x	x	x
L2	Model Building - Students will leverage techniques such as regression and decision trees to build Machine Learning models that enable accurate and intelligent predictions. Students may explore Python, R or SAS to build your model. Students will follow the complete model-building exercise from data split to test and training and validating data using the k-fold cross-validation process.	YES	x	x	x	x
L3	Model Fine-tuning - Students will apply various techniques to improve the accuracy of their model and select the champion model that provides the best accuracy.	YES	x	x	x	x
L4	Dashboarding and Representing Results - As the final step, students will be required to export their results into a dashboard with meaningful insights using Tableau	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Pass/Fail/Pass with Distinction

Mandatory Midterm Exam: N/A

Final Exam: N/A

Quizzes Multiple Choice: N/A

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA300 - R PROGRAMMING FOR DATA SCIENCE

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Recommended	MSDA100 DATA SCIENCE IN REAL LIFE (4 ECTS) and MSDA101 STATISTICS ESSENTIAL (4 ECTS)
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Students to gain insight into the R Programming language with this introductory course. An essential programming language for data analysis, R Programming is a fundamental key to becoming a successful Data Science professional. In this course students will learn how to write R code, learn about R's data structures, and create your own functions. After the completion of this course, students will be fully able to begin their first data analysis.

LEARNING OBJECTIVES:

- Learn about math, variables, and strings, vectors, factors, and vector operations
- Gain fundamental knowledge on arrays and matrices, lists, and data frames
- Get understanding on conditions and loops, functions in R, objects, classes, and debugging
- Learn how to accurately read text, CSV and Excel files plus how to write and save data objects in R to a file
- Understand and work on strings and dates in R

CONTENT

Lesson 1 - R Basics

Lesson 2 - Data Structures in R

Lesson 3 - R Programming Fundamentals

Lesson 4 - Working with Data in R Lesson 5
 - Stings and Dates in R

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Learn about math, variables, and strings, vectors, factors, and vector operations	YES	X	X	X	X

L2	Gain fundamental knowledge on arrays and matrices, lists, and data frames	YES	X	X	X	X
L3	Get understanding on conditions and loops, functions in R, objects, classes, and debugging	YES	X	X	X	X
L4	Learn how to accurately read text, CSV and Excel files plus how to write and save data objects in R to a file	YES	X	X	X	X
L5	Understand and work on strings and dates in R	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA301 - DEEP LEARNING FUNDAMENTALS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Recommended	MSDA100 DATA SCIENCE IN REAL LIFE (4 ECTS) and MSDA101 STATISTICS ESSENTIAL (4 ECTS) Mathematics - Linear Algebra
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course is designed to help students learn the fundamentals of Deep Learning. It will make students familiar with the concepts of Deep Learning, Convolutional neural networks, and the effectiveness of Deep Learning. This course examines the rapidly growing field in Data Science with neural networks .

LEARNING OBJECTIVES:

- Gain understanding of Deep Learning
- Understand Deep Learning models such as convolutional networks, recurrent nets, Autoencoders, Recursive Neural Tensor Nets, and Deep Learning Use Cases
- Comprehend Deep Learning platforms and software libraries

CONTENT

Lesson 1 - Introduction to Deep Learning

Lesson 2 - Deep Learning Models

Lesson 3 - Additional Deep Learning Models

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Gain understanding of Deep Learning	YES	x	x	x	x
L2	Understand Deep Learning models such as convolutional networks, recurrent nets, Autoencoders, Recursive Neural Tensor Nets, and Deep Learning Use Cases	YES	x	x	x	x
L3	Comprehend Deep Learning platforms and software libraries	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA302 - DEEP LEARNING WITH TENSORFLOW

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Recommended	MSDA101 STATISTICS ESSENTIAL (4 ECTS) , MSDA104 PYTHON FOR DATA SCIENCE (4 ECTS), and MSDA201 MACHINE LEARNING (4 ECTS)
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Deep Learning with Tensorflow will refine the students Machine Learning knowledge and make them an expert in Deep Learning using TensorFlow. Students will master the concepts of Deep Learning and TensorFlow to build artificial neural networks and traverse layers of data abstraction. This course will help students learn to unlock the power of data and in Artificial Intelligence.

LEARNING OBJECTIVES:

- Understand the difference between linear and non-linear regression
- Comprehend Convolutional Neural Networks and their applications
- Gain familiarity on Recurrent Neural Networks (RNN) and Autoencoders
- Learn how to filter with Restricted Boltzmann Machine

CONTENT

Lesson 1 - Introduction to TensorFlow

Lesson 2 – Convolutional Neural Networks (CNN)

Lesson 3 – Recurrent Neural Networks (RNN)

Lesson 4 - Unsupervised Learning

Lesson 5 - Autoencoders

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Understand the difference between linear and non-linear regression	YES	x	x	x	x
L2	Comprehend Convolutional Neural Networks and their applications	YES	x	x	x	x

L3	Gain familiarity on Recurrent Neural Networks (RNN) and Autoencoders	YES	x	x	x	x
L4	Learn how to filter with Restricted Boltzmann Machine	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA303 - NATURAL LANGUAGE PROCESSING

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Recommended	Term I and Term II Courses
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This Natural Language Processing course will give Students a detailed look at the science behind applying Machine Learning algorithms to process large amounts of natural language data. Students will learn the concepts of Natural Language understanding, Feature Engineering, Natural Language Generation and Speech Recognition techniques.

LEARNING OBJECTIVES:

- Learn how to perform text processing and find a pattern
- Find the most relevant document by applying TF-IDF
- Write a script for applying parts-of-speech and extraction on focus words
- Create your own NLP module
- Classify the cluster for articles
- Create a basic speech model
- Convert speech to text

CONTENT

Lesson 1 - Introduction to Natural Language Processing

Lesson 2 - Feature Engineering on Text Data

Lesson 3 - Natural Language Understanding Techniques

Lesson 4 - Natural Language Generation

Lesson 5 - Natural Language Processing Libraries

Lesson 6 - Natural Language Processing with Machine Learning and Deep Learning

Lesson 7 - Speech Recognition Technique

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Learn how to perform text processing and find a pattern	YES	x	x	x	x

L2	Find the most relevant document by applying TF-IDF	YES	x	x	x	x
L3	Write a script for applying parts-of-speech and extraction on focus words	YES	x	x	x	x
L4	Create your own NLP module	YES	x	x	x	x
L5	Classify the cluster for articles	YES	x	x	x	x
L6	Create a basic speech model	YES	x	x	x	x
L7	Convert speech to text	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: \geq 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

CORE COURSE

CODE: MSDA304/305 - ARTIFICIAL INTELLIGENCE COMPREHENSIVE CAPSTONE PROJECT

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 34

Course duration: N/A

Total contact hours: N/A

Total exam hours: N/A

Total study hours: Self-directed Research 650hrs

Language of instruction: English

Pre-requisites	Completion of Term I, II and III courses
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This Artificial Intelligence Capstone project will allow students to implement the skills learned in the Program. Students will demonstrate know-how to solve a real industry-aligned problem. Students subscribe to a SQL coding resource and apply various Artificial Intelligence based techniques like Regression, SVM, Tree-based algorithms, NLP, etc. The project is the final step in the Program.

Students will continue this Capstone in groups of not more than 3 (three). This is therefore an opportunity to collectively develop and implement a data science solution and explore potential employment partnerships. Students should showcase their expertise in Data Science to future or current employers.

LEARNING OBJECTIVES:

- The Problem / Challenge; Describe the problem or challenge to be addressed in the project. Include the context of the problem such as the organization, locality, industry etc.
- Data Acquisition; Describe the source and method used to acquire the data for the project
- Data Processing; In this step, students will apply various data processing techniques to make raw data meaningful. Students must subscribe to SQL coding resource <https://www.blazesql.com>
- Model Building and Fitting - This will be performed using Machine Learning algorithms like regression, multinomial Naïve Bayes, SVM, tree-based algorithms, etc.
- Unsupervised Learning - Clustering to group similar kind of transactions/reviews using NLP and

related techniques to devise meaningful conclusions.

- Model Deployment - Deploy the model and demonstrate its working in a real-world scenario.
- Results - are to be submitted in the Submission Area for final evaluation as per the rubric guidelines.

CONTENT

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Exploratory Data Analysis - In this step, you will apply various data processing techniques to determine the features and correlation between them, transformations required to make the data sense, new features, construction, etc.	YES	x	x	x	x
L2	Model Building and fitting - This will be performed using Machine Learning algorithms like regression, multinomial Naïve Bayes, SVM, tree-based algorithms, etc.	YES	x	x	x	x
L3	Unsupervised learning - Clustering to group similar kind of transactions/reviews using NLP and related techniques to devise meaningful conclusions.	YES	x	x	x	x
L4	Representing results - As a last step, you will be required to export your results into a dashboard with useful insights.	YES	x	x	x	x

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Pass/Fail/Pass with Distinction
Mandatory Midterm Exam: N/A
Final Exam: N/A
Quizzes Multiple Choice: N/A

BIBLIOGRAPHY: TBD

SPECIALIZATION COURSES

FINANCIAL MARKETS

SPECIALIZATION COURSE

CODE: MSF103 - FIXED INCOME SECURITIES AND CREDIT MARKETS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

The goals of this course are to describe important fixed income securities and markets and develop tools for valuing fixed income securities and managing interest rate risk. The course covers traditional bonds and term structure concepts as well as fixed-income derivatives and interest rate modelling.

COURSE OBJECTIVES

- Introduce important fixed income securities such as bonds, forward rate agreements, futures, swaps, interest rate options (Caps, Floors, and Swap options)
- Develop tools for pricing and hedging the fixed income securities
- Discuss tools for managing interest rate risk
- Introduce term structure models

COURSE OUTCOMES

Course outcomes: On completion of the course, students will be able to:

- Identify and distinguish between the different types of fixed income securities;
- Demonstrate how to apply derivative instruments to hedge the risks and enhance the returns of fixed income securities;
- Make use of analytic tools in bond portfolio management and interest rate risk management;
- Identify various sources of credit risk and apply structural models to estimate the risk

COURSE CONTENT

Unit 1: Introduction and Valuation of Fixed Cash Flows

- Valuation
- Yield to maturity
- No arbitrage valuation

Unit 2: The Interest Rate Sensitivity of Instruments with Fixed Cash Flows

- Duration and convexity

Unit 3: Introduction to Variable Cash Flows

- Floating rate notes
- Inverse floaters
- Interest rate Swap

Unit 4: Valuation and Interest Rate Sensitivity of Interest-Rate Dependent Cash Flows

- Valuing cash flows
- Characteristics of Interest rates

Unit 5: Fixed-Income Options

- Callable bonds
- Caps, floors
- Swap options

Unit 6: The Credit Market

- Credit risk
- Credit default swaps

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L 1	Identify and distinguish between the different types of fixed income securities;	NO	X	X	X	X
L 2	Demonstrate how to apply derivative instruments to hedge the risks and enhance the returns of fixed income securities;	YES	X	X	X	X

L 3	Make use of analytic tools in bond portfolio management and interest rate risk management;	YES	X	X	X	X
L 4	Identify various sources of credit risk and apply structural models to estimate the risk	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Colquitt, J., Credit Risk Management: How to Avoid Lending Disasters and Maximise Earnings, McGraw-Hill

SPECIALIZATION COURSE

CODE: MSF 200 - RISK MANAGEMENT IN FINANCIAL MARKETS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

The course explains different types of financial crises, why financial intermediaries exist, how to identify, measure and manage risks in financial institutions. The focus is on interest rate risk, market risk, credit risk, and foreign exchange and liquidity risks. The course gives a good understanding of how to run financial institutions, sovereign debt crises and how to regulate markets to avoid crises. This process, known as the risk management process, is becoming an increasingly important tool in the management of a business and personal financial health. An effective and efficient corporate risk management program leads to knowledge and control of costs and an improved bottom line. The risk management process involves identification of risks and associated potential costs, analysis of the causes of risk of financial loss, determination of various strategies to treat risk, selection of strategies appropriate to the goals and objectives of the business, implementation of the selected strategies, management and monitoring of results. Making adjustments, adapting to external and internal forces, and crisis or disaster management are incorporated in the corporate risk management process.

COURSE OBJECTIVES

This course will examine the way in which business and society make an assessment of, control and transfer risk. The goal of this course is to engage students in active discovery of risk management principles. Students will be prepared to function in a business environment, developing an awareness of the challenges, the tools, and the process of designing and implementing a risk management program. This course focuses on the ways in which businesses and society assess, control, and transfer risk.

COURSE OUTCOMES

Upon completion of the course, students will know the main concepts to quantify and manage all kind of risks of financial institutions.

They will:

- Understand the meaning of risk and the ethical considerations
- Know the role and purpose of risk management.
- Be conversant with the core elements of the risk management process.
- Understand the different categories of risk.
- Critically be able to assess current trends in risk management.
- Have the ability to evaluate the position of insurance within risk management.
- Understand the key risk management lessons learnt from major loss events

COURSE CONTENT

Unit 1: Understanding the meaning of risk

- Risk and certainty
- Probability theory
- Risk perception
- Ethical Considerations

Unit 2: The Role and purpose of risk management

- Benefits of risk management
- Roles and responsibilities, management, compliance and audit functions

Unit 3: The core elements of the risk management process

- Risk register
- Risk management standards
- Regulatory and corporate governance context=

Unit 4: Categories of risk

- Financial, operational, Insurance strategic and reputation
- Categorising risks
- Cause, events and effects

Unit 5: Current trends in risk management

- Enterprise risk management (ERM)
- Governance Risk and Compliance (GRC)
- Risk aggregation and correlation

Unit 6: Insurance within Risk management

- Alternatives to insurance, risk transfer

Unit 7: Key lessons from major loss events

- Examples,
- Consequences of failure in risk management systems

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L 1	Understand the meaning of risk and the ethical considerations	NO	X	X	X	X
L 2	Know the role and purpose of risk management.	NO	X	X	X	X
L 3	Be conversant with the core elements of the risk management process	YES	X	X	X	X
L 4	Understand the different categories of risk.	YES	X	X	X	X
L 5	Critically be able to assess current trends in risk management.	YES	X	X	X	X
L6	Have the ability to evaluate the position of insurance within risk management.	YES	X	X	X	X
L7	Understand the key risk management lessons learnt from major loss events	NO	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ✗ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Measuring and Managing Credit Risk, Servigny & Renault, McGraw Hill

SPECIALIZATION COURSE

CODE: MSF201- FINANCIAL MARKETS AND INSTITUTIONS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course gives fundamental knowledge on the structure, function and role of the financial system in light of the complex web of links and interconnections with the banking sector. The course will cover financial intermediaries, financial instruments and the different markets where credit institutions are active players.

COURSE OBJECTIVES

The objective of this course is to provide students with an introduction to the theory and practice of financial markets and institutions.

- To help students to gain a thorough understanding of the workings of financial markets and of financial instruments
- To introduce the students to the management of financial markets and institutions in an international context

COURSE OUTCOMES

On completion of this course, the student will be able to:

- Understand and critically discuss economic principles behind the determination of interest rates.
- Be conversant with what determines the demand and supply of money.

- Communicate thoughts and critically discuss why financial institutions exist. • understand and critically discuss how the prices of equities are determined and different degrees of stock market efficiency.
- Evaluate and distinguish between different types of money and bond markets instruments and how these markets work.

COURSE CONTENT

Unit 1: Fundamentals of Financial Markets

- Interest rates and valuation
- The behaviour of interest rates

Unit 2: Fundamentals of Institutions

- - Financial Crisis
- - Central Banks and Monetary Policy

Unit 3: Financial Markets

- Money Markets
- Bond Markets
- Stock Markets
- Forex Markets
- Decentralised Markets and Fintech

Unit 4: Financial Institutions

- Banking and Management
- Financial Regulation
- Banking Industry/OTC
- Ethical considerations and governance

Learning Outcomes:		Assessed in this module?	A	B	C	D
On successful completion of the course the candidate will be able to:						
L1	understand and critically discuss economic principles behind the determination of interest rates..	YES	X	X	X	X
L 2	Be conversant with what determines the demand and supply of money.	YES	X	X	X	X
L 3	communicate thoughts and critically discuss why financial institutions exist.	YES	X	X	X	X
L 4	understand and critically discuss how the prices of equities are determined and different degrees of stock market efficiency.	YES	X	X	X	X
L 5	evaluate and distinguish between different types of money and bond markets instruments and how these markets work	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: \approx 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Financial Markets and Institutions, Saunders, McGraw-Hill

SPECIALIZATION COURSE

CODE: MSF301 - CORPORATE INVESTMENT AND FINANCIAL POLICY

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course examines techniques and issues in corporate finance with a focus on corporate investment decisions. The course covers several aspects of valuation in a corporate setting: estimation of free cash flow, stock valuation along with recognition of growth opportunities, risk management strategies, estimation of beta using online data, and specifying market scenarios to identify sustainable growth outcomes when evaluating investment proposals. Further topics include merger and acquisition strategies, the examination of options embedded in corporate capital structures, incentive-aligning compensation including executive stock options, and techniques for measuring financial performance including Economic Value Added.

COURSE OBJECTIVES

- To understand the characteristics of various financial policies including investment in assets and capital structure
- To understand the key factors affecting financial performance
- To understand the features of specific forms of domestic and international business finance and identify the circumstances when each is appropriate
- To understand the key variables affecting financial performance, and
- To understand the principles of risk minimisation strategies including exchange rate and interest rate risk management.

COURSE OUTCOMES

On successful completion of this course, students will be able to:

- Apply percent of sales approach to identify external financing needed at a given growth rate, and use formulas and pricing models to measure growth opportunities
- Employ various capital budgeting techniques in decision-making
- Apply option pricing models including real options methods, to evaluate corporate investments
- Utilise leading techniques in the valuation of merger and acquisition strategies
- Analyse corporate investment decisions in the context of corporate diversification and corporate governance
- Identify & apply ethical principles relevant to the finance profession

COURSE CONTENT

Unit 1: Long term financing

- Bond and stock valuation
- Cost of capital
- Dividend returns

Unit 2: Performance Analysis and Business Planning

- Financial Statement Analysis
- Financial Forecasting
- Business valuation
- Bankruptcy and Restructuring

Unit 3: Long-term investment decision

- Capital budgeting-Evaluation methods
- Capital Budgeting-Cash flow methods
- Capital Budgeting Risk Analysis
- Lease analysis

Unit 4: Working capital policy

- Cash management
- Credit policy/Receivables management
- Hedging Futures and options

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L 1	Apply percent of sales approach to identify external financing needed at a given growth rate, and use formulas and pricing models to measure growth opportunities	YES	X	X	X	X
L 2	Employ various capital budgeting techniques in decision-making	YES	X	X	X	X

L 3	Apply option pricing models including real options methods, to evaluate corporate investments	YES	X	X	X	X
L 4	Utilise leading techniques in the valuation of merger and acquisition strategies	YES	X	X	X	X

L 5	Analyse corporate investment decisions in the context of corporate diversification and corporate governance	YES	X	X	X	X
L6	Identify & apply ethical principles relevant to the finance profession	NO	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Foundations of Financial Management, Block & Danielsen, McGraw-Hill

SPECIALIZATION COURSE

CODE:MSF302 - MERGERS, BUYOUTS AND CORPORATE RESTRUCTURINGS

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrsResearch)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course focuses on identifying ways to increase firm value through corporate restructuring. Specific topics include mergers and tender offers, spin-offs, carve-outs, divestitures, takeover defence strategies, bankruptcy and bankruptcy acquisitions, international acquisitions, leveraged buyouts. We will cover the theory, practice and empirical evidence related to each of these topics. Emphasis will be placed on valuation analysis, understanding deal types, understanding expectations on outcomes, transactional evaluation, and strategic considerations.

COURSE OBJECTIVES

The aim of the course is for the students to understand the motivations, decision processes, transaction execution, and valuation consequences of financial, business, and organizational restructuring by corporate units. The course facilitates developing ability among students to plan, evaluate, and execute corporate restructuring strategies using financial modelling and quantitative techniques. In addition, the objective of this course is to enable students to appreciate the fundamental issues involved in the structure and functioning of the market for corporate control within the framework of finance theory

COURSE OUTCOMES

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

- Discuss the basic steps that the merging firms go through in a typical M&A process, starting from deal initiation until deal completion
- Apply the relevant valuation techniques to assess the values of the assets of the merging firms
- Describe the key negotiation items between the merging firms in a merger process and assess their economic implications for both parties.

COURSE CONTENT

Unit 1: Valuation Strategies

- Tender offers and the free rider problem
- Measurements of performance
- Current trends in restructuring
- Valuing distressed businesses

Unit 2: Structuring transactions

- Mergers vs. Tender Offers
- Means of payment
- Tax effects

Unit 3: Takeover defences

- Merger negotiations
- Tactics of takeover attack/defence

Unit 4: International M&A

- Measurement of performance
- Drivers of M&A activity

Unit 5: Bankruptcy acquisition

- Bankruptcy auctions and fire-sales
- Divestitures, spin-offs, and equity carve-outs
- Distressed debt investments

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Discuss the basic steps that the merging firms go through in a typical M&A process, starting from deal initiation until deal completion	NO	X	X	X	X

L2	Apply the relevant valuation techniques to assess the values of the assets of the merging firms	YES	X	X	X	X
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L3	Describe the key negotiation items between the merging firms in a merger process and assess their economic implications for both parties.	YES	X	X	X	X
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A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: The Art of M&A: A Merger Acquisition Buyout Guide, Reed & Lajoux, McGraw-Hill

SPECIALIZATION COURSE

CODE: MSF303 - PORTFOLIO MANAGEMENT

COURSE DETAILS

Course level: Graduate

Course category: Core Course

Course credits: 4

Course duration: 10 weeks

Total contact hours: 35 (15hrs Lectures + 20hrs Discussion Forums)

Total exam hours: 4

Total study hours: 76 (40hrs Self-directed + 36hrs Research)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

The course will focus on the application of financial theory to the issues and problems of investment management. Topics will include portfolio optimization and asset allocation, the basics of bond pricing and debt portfolio management, the theory of asset pricing models and their implications for investment as well as techniques for evaluating investment management performance. The course will build upon the analytical skills developed in prior courses.

COURSE OBJECTIVES

Students will learn to design and implement an investment policy statement for an individual or institutional investor that establishes their financial objectives, risk tolerances, constraints, and investment and monitoring policies. Topics include:

- setting investment objectives and policies
- ethical standards and fiduciary duties
- diversification and asset allocation
- capital markets and market efficiency
- equity portfolio management
- fixed-income portfolio management
- alternative investments portfolio management
- evaluating portfolio performance, and monitoring and rebalancing portfolios

COURSE OUTCOMES

Upon completing this course, students will be able to:

- Construct a policy statement reflecting the objectives and risk tolerances of various types of individual and institutional investors.
- Formulate a personal code of ethics based on industry standards and fiduciary duties.
- Evaluate the effect of risk on investment decisions.
- Justify their view on market efficiency using both theoretical and empirical arguments.
- Analyze the gains from diversification and asset allocation
- Develop an integrated portfolio management plan including equities, fixed income assets and alternative investments reflecting the goals, risk tolerance, and circumstances of individual and institutional investors.
- Appraise portfolio performance using appropriate methodologies.
- Assess various monitoring and rebalancing strategies.

COURSE CONTENT

Unit 1: Securities markets and Investment Vehicles

- Asset classes
- Role of global security exchanges
- Market regulation
- Utility and Risk aversion

Unit 2: Portfolio theory and quantitative tools

- Risk and return features
- Sharpe ratio and portfolio efficiency
- CAPM and Markowitz optimization

Unit 3: Models with Multiple sources of risk

- APT: Theory
- APT: Estimation

Unit 4: Investment Management

- Active vs. passive management
- Liquidity
- International Diversification
- Risk Management
- Ethical considerations

Learning Outcomes:		Assessed in this module?	A	B	C	D
	On successful completion of the course the candidate will be able to:					
L 1	Construct a policy statement reflecting the objectives and risk tolerances of various types of individual and institutional investors.	YES	X	X	X	X
L 2	Formulate a personal code of ethics based on industry standards and fiduciary duties.	YES	X	X	X	X

L 3	Evaluate the effect of risk on investment decisions.	YES	X	X	X	X
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L 4	Justify their view on market efficiency using both theoretical and empirical arguments.	YES	X	X	X	X
L 5	Analyze the gains from diversification and asset allocation	YES	X	X	X	X
	Develop an integrated portfolio management plan including equities, fixed income assets and alternative investments reflecting the goals, risk tolerance, and circumstances of individual and institutional investors.	YES	X	X	X	X
	Appraise portfolio performance using appropriate methodologies; Assess various monitoring and rebalancing strategies.	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Principles of investment, Bodie, McGraw Hill

FINTECH AND BLOCKCHAIN

SPECIALIZATION COURSE

CODE: BSDL101 - INTRODUCTION TO DIGITAL CURRENCIES, ICOs& MARKETS

COURSE DETAILS

Course level: Undergraduate

Course category: Specialization Course

Course credits: 10

Course duration: 13 weeks

Total contact hours: 44.5 (19.5hrs Lectures + 25hrs Discussion Forum)

Total exam hours: 2

Total study hours: 230 (117hrs self-directed + 9hrs Specific assignments + 4hrs Research + 100 Preparation)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course was designed for individuals and organizations who want to learn how to navigate investment in cryptocurrencies. Students will learn how to define a currency, analyze the foundations of digital signatures and blockchain technology in cryptocurrency, and accurately assess the risks of cryptocurrency in a modern investment portfolio. By the end of this course, students will have a deep understanding of the realities of Cryptocurrency, the intricacies of Blockchain technology, and an effective strategy for incorporating Cryptocurrency into investment plans.

COURSE OBJECTIVES

The course will survey the theory and principles by which cryptocurrencies operate, practical examples of basic cryptocurrency use, including clients, wallets, transactions. We'll look at the cryptocurrency ecosystem financial services and discuss the existing and potential interaction of cryptocurrencies with the banking, financial, legal and regulatory environment. Lastly, the course will examine in detail how cryptocurrencies can be viewed from an innovation perspective and what opportunities they present for the developing world.

COURSE CONTENT

- Fundamental technology components of blockchain-based digital currencies
- Advanced uses of the blockchain, escrow services, multi-signature transactions, asset registration, attestation and smart contracts applications.
- Alternative blockchains to Bitcoin
- Cryptocurrencies and the monetary and banking systems,
- Regulation and cryptocurrencies
- Developing, financial inclusion and economic development.

COURSE OUTCOMES

At the completion of the course the student will be able to:

- Understand the fundamental technology components of blockchain-based digital currencies, the process of currency issuance, proof-of-work and alternative consensus mechanisms, how they are applied and how the distributed ledger is structured in its core.
- Understand more advanced uses of the blockchain such as escrow services, multi-signature transactions, asset registration, attestation and smart contracts applications.
- Understand alternative blockchains to Bitcoin, such as alt-coins and Ethereum and IOU-based systems like Ripple.
- Understand what parallels and differences cryptocurrencies have with the existing monetary and banking systems, what approaches are the same and what is fundamentally different.
- Understand existing approaches by regulators globally, and the likely frameworks for regulating cryptocurrencies, and their interface with conventional finance, in the future.
- Be able to critically judge on their own, whether cryptocurrencies are disruptive innovations, and what hurdles, bottlenecks or avenues exist towards wider adoption, as well as the potential they present for leapfrogging infrastructure in developing nations and the potential they present for improving financial inclusion and economic development.

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Understand the fundamental technology components of blockchain-based digital currencies, the process of currency issuance, proof-of-work and alternative consensus mechanisms, how they are applied and how the distributed ledger is structured in its core.	YES	X	X	X	X
L2	Understand more advanced uses of the blockchain such as escrow services, multi-signature transactions, asset registration, attestation and smart contracts applications.	NO	X	X	X	X
L3	Understand alternative blockchains to Bitcoin, such as alt-coins and Ethereum and IOU-based systems like Ripple.	YES	X	X	X	X
L4	Understand what parallels and differences cryptocurrencies have with the existing monetary and banking systems, what approaches are the same and what is fundamentally different.	YES	X	X	X	X

L5	Understand existing approaches by regulators globally, and the likely frameworks for regulating cryptocurrencies, and their interface with conventional finance, in the future.	YES	X	X	X	X
L6	Be able to critically judge on their own, whether cryptocurrencies are disruptive	NO	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≈ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

SPECIALIZATION COURSE

CODE: BSDL102 - CYBER SECURITY RISK REGULATION

COURSE DETAILS

Course level: Undergraduate

Course category: Specialization Course

Course credits: 10

Course duration: 13 weeks

Total contact hours: 44.5 (19.5hrs Lectures + 25hrs Discussion Forum)

Total exam hours: 2

Total study hours: 230 (117hrs self-directed + 9hrs Specific assignments + 4hrs Research + 100 Preparation)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

Cybersecurity is a complex, sophisticated, and growing challenge. This course explores cybersecurity topics from a business context in alignment with prevailing standards and guidelines. The major domains of security are explored from organizational management, risk, and technical perspectives. Critical security goals of Confidentiality, Integrity, and Availability are discussed. The emerging threat landscape is examined, including attacker motives and tactics. The concept of system vulnerabilities is explained along with a review of enterprise techniques for vulnerability management. The security challenge is presented from the enterprise perspective, with attention to the intersection of individual, organizational, and technical cybersecurity concerns.

COURSE OBJECTIVES

- To introduce the fundamental concepts of information and cybersecurity in the business enterprise.
- To explore the threats and vulnerabilities associated with business systems.
- To understand the core domains of security as presented in widely accepted cybersecurity frameworks.
- To explain critical cybersecurity technical components as related to the respective security domains.
- To introduce cyber risk management concepts.
- To explore the challenges of communicating cybersecurity concepts to business executives

COURSE CONTENT

- Concepts of cybersecurity and technical risks
- Security goals in information systems

- Cyber risk in a systems environment.
- Cyber security threats
- Common security frameworks to treat cyber risks

COURSE OUTCOMES

At the completion of the course:

- Students will be able to communicate concepts of cybersecurity and technical risks to management, executives, and other non-technical audiences.
- Students will recognize common security goals in information systems.
- Students will explain the characteristics of information or cyber risk in a systems environment.
- Students will understand the prevailing information and cybersecurity threats.
- Students will be able to apply common security frameworks to treat cyber risks

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Students will be able to communicate concepts of cybersecurity and technical risks to management, executives, and other non-technical audiences.	NO	X	X		
L2	Students will recognize common security goals in information systems.	YES	X	X	X	X
L3	Students will explain the characteristics of information or cyber risk in a systems environment.	YES	X	X	X	X
L4	Students will understand the prevailing information and cyber security threats.	YES	X	X	X	X
L5	Students will be able to apply common security frameworks to treat cyber risks	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD

SPECIALIZATION COURSE

CODE: BSDL200 - BLOCKCHAIN TECHNOLOGY FUNDAMENTALS

COURSE DETAILS

Course level: Undergraduate

Course category: Specialization Course

Course credits: 10

Course duration: 13 weeks

Total contact hours: 44.5 (19.5hrs Lectures + 25hrs Discussion Forum)

Total exam hours: 2

Total study hours: 230 (117hrs self-directed + 9hrs Specific assignments + 4hrs Research + 100 Preparation)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

The course will cover the most important blockchain concepts, the philosophy of decentralization behind blockchain, and the main discussions within the blockchain environment.

COURSE OBJECTIVES

The objectives of the Blockchain Fundamentals course consists of knowledge and practical skills components. We will work according to a 'Flipped Learning' methodology. This means that we will create a learning environment in which you, together with your peers, can actively develop your knowledge and skills. You will be put in charge of your own learning progress.

COURSE CONTENT

- History, technology, and applications of Blockchain
- Blockchain applications and concepts
- Creating a Crypto token and initial Coin Offering
- Cryptocurrency exchanges and wallets
- Blockchain startups

COURSE OUTCOMES

At the completion of the course the student will be able to:

- The student will be able to comfortably discuss and describe the history, technology, and applications of Blockchain
- The student will be able to assess Blockchain applications in a structured manner
- The student will be able to present Blockchain concepts clearly and persuasively
- The student will be able to create their own Crypto token
- The student will be able to create their own Initial Coin Offering
- The student will be able to use cryptocurrency exchanges and wallets safely
- The student will gain familiarity with investing in Blockchain startups

Learning Outcomes: On successful completion of the course the candidate will be able to:	Assessed in this module?	A	B	C	D
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L1	The student will be able to comfortably discuss and describe the history, technology, and applications of Blockchain	NO	X	X		
L2	The student will be able to assess Blockchain applications in a structured manner	YES	X	X	X	X
L3	The student will be able to present Blockchain concepts clearly and persuasively	YES	X	X	X	X
L4	The student will be able to create their own Crypto token and, gain familiarity with investing in Blockchain startups	YES	X	X	X	X
L5	The student will be able to create their own Initial Coin Offering	YES	X	X	X	X
L6	The student will be able to use cryptocurrency exchanges and wallets safely	NO	X	X		

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY

- Bibliography: Foundations of Financial Management, Block & Danielsen, McGraw-Hill

SPECIALIZATION COURSE

CODE: BSDL300 -PRINCIPLES IN INNOVATION DISRUPTION

COURSE DETAILS

Course level: Undergraduate

Course category: Specialization Course

Course credits: 10

Course duration: 13 weeks

Total contact hours: 44.5 (19.5hrs Lectures + 25hrs Discussion Forum)

Total exam hours: 2

Total study hours: 230 (117hrs self-directed + 9hrs Specific assignments + 4hrs Research + 100 Preparation)

Language of instruction: English

Pre-requisites	N/A
Co-requisites	N/A
Prohibited Combinations	N/A

COURSE OVERVIEW

This course will examine how innovation-driven by emerging technologies is transforming the way we do business and disrupting well-established industries. The driver for the current and imminent wave of disruption is the emergence of technological breakthroughs that can be leveraged by innovative entrepreneurs and forward-thinking companies. Though fast and agile processes, creative innovators are indeed able to appropriate these new technologies and adapt them to relevant use cases that could potentially disintermediate traditional lines of business, or deliver previously unthought-of business models. Some of these technologies are embodied in current buzzwords such as: Big Data, Machine Learning, Artificial Intelligence, Blockchain, Synthetic Biology, Digital Fabrication, Industry 4.0, Internet of Things. Harnessing these emerging technologies and creating innovative business models around them is a process that requires a good knowledge of entrepreneurial principles such as Lean Start-up and Rapid Prototyping, but also a fundamental understanding of the principles behind the technologies in question. For this reason, this course places itself at the intersection between business and technology and aims at strengthening the students' holistic understanding of the interplay between these two domains.

COURSE OBJECTIVES

The objectives of this course are twofold: First, to introduce principles of disruptive innovation in entrepreneurial and economic settings. Second, to focus on disruptive innovation in the sphere of blockchain technology and discuss the potential disruption within various industries.

COURSE CONTENT

- Fundamentals of disruptive technologies

- Advances in disruptive technologies (Start-ups, Industry players and consortia, Software providers, Government and regulators, etc.),
- Business use-cases
- New business models and evolving infrastructures
- Challenges in entrepreneurial activities, cross-industry collaboration and engagement
- Issues and dilemmas in disruptive technologies, ethics, privacy, sustainability, and legislation

COURSE OUTCOMES

At the completion of the course the student will be able to have:

- Clear and critical grasp of the fundamentals of the covered disruptive technologies, their promise as well as their current limitations
- Overview over the ecosystem of stakeholders pushing advances in disruptive technologies forward (Start-ups, Industry players and consortia, Software providers, Government and regulators, etc.), and ability to individually map out the ecosystem for a given technology.
- Knowledge of pertinent business use-cases related to specific technologies, and the ability to assess these use-cases
- Ability to conceptualize and understand new business models based on collaborative, open, and continuously evolving infrastructures
- Awareness and understanding of challenges involved in engaging in entrepreneurial activities in the domain of technologies that are at an early maturity stage
- Awareness of the importance of cross-industry collaboration and engagement in the process of ongoing standards-building for new technologies.
- Understanding of issues and dilemmas in the development of disruptive technologies related to ethics, privacy, sustainability, and legislation

Learning Outcomes: On successful completion of the course the candidate will be able to:		Assessed in this module?	A	B	C	D
L1	Clear and critical grasp of the fundamentals of the covered disruptive technologies, their promise as well as their current limitations	NO	X	X		
L2	Overview over the ecosystem of stakeholders pushing advances in disruptive technologies forward (Start-ups, Industryplayers and consortia, Software providers, Government and regulators, etc.), and ability to individually map out the ecosystem for a given technology.	YES	X	X	X	X
L3	Knowledge of pertinent business use-cases related to specific technologies, and the ability to assess these use-cases	NO	X	X		
L4	Awareness of the importance of cross-industry collaboration and engagement in the process of ongoing standards-building for new technologies.	YES	X	X	X	X

L5	Ability to conceptualize and understand new business models based on collaborative, open, and continuously evolving infrastructures	YES	X	X	X	X
L6	Understanding of issues and dilemmas in the development of disruptive technologies related to ethics, privacy, sustainability, and legislation	NO	X	X		
L7	Awareness and understanding of challenges involved in engaging in entrepreneurial activities in the domain of technologies that are at an early maturity stage	YES	X	X	X	X

A – Knowledge and Understanding B – Intellectual Skills C – Practical Skills D – Transferable Skills

Assessments

Forum 5% Mandatory

Midterm Exam: ≥ 40% (Recommendation 30%)

Final Exam: 30-40%. (Recommendation 40%)

Quizzes Multiple Choice: 25 % (adjustable)

BIBLIOGRAPHY: TBD