## COURSE DETAILS

<table>
<thead>
<tr>
<th>Course Code:</th>
<th>F71RA</th>
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<tbody>
<tr>
<td>Full Course Title:</td>
<td>Machine Learning for Risk and Insurance 1</td>
</tr>
<tr>
<td>SCQF Level:</td>
<td>11</td>
</tr>
<tr>
<td>SCAF Credits:</td>
<td>15</td>
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<tr>
<td>Available as Elective:</td>
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### DELIVERY LEVEL

<table>
<thead>
<tr>
<th>Undergraduate:</th>
<th>No</th>
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<tr>
<td>Postgraduate Taught:</td>
<td>Yes</td>
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<tr>
<td>Postgraduate Research:</td>
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### COURSE AIMS

The intention of this course is to introduce students to core mathematical and statistical components of modern machine learning methods that are directly of applicability in the risk, insurance and financial mathematics contexts. In addition, the applications presented, and R computer packages explored in the applications will be focussed primarily on this discipline specific context. This course will aim to cover unsupervised learning methods of relevance to insurance and risk management.

### LEARNING OUTCOMES – SUBJECT MASTERY

- An understanding of selected core fundamental concepts in data science, statistics and machine learning of unsupervised learning.
- An ability to apply unsupervised learning methods to problems arising in insurance and finance
- An understanding of the mathematics underpinning unsupervised machine learning techniques.

- Critical awareness of the appropriateness and performance of the different techniques, as well as the relationships between them.

### LEARNING OUTCOMES – PERSONAL ABILITIES

- Rational problem identification and definition.
- Proficiency in the implementation of machine learning methods in R software for Risk and Insurance applications and data analysis.
- Critical analysis and solution selection

- Demonstrate the ability to learn independently.
- Manage time, work to deadlines, and prioritise workloads.

- Use appropriate computer software to process data.
- Present results in a way that demonstrates a good understanding of the technical and broader issues of data mining and machine learning.
SYLLABUS

Unsupervised Learning Methods

Clustering Methods

- To understand the impossibility theorem of clustering and the axioms of Clustering methods: to gain an understanding of mathematical trade-offs for different classes of clustering method.
- Data preparation for clustering methods: transforms and features.
- Classes of clustering methods and algorithms.
- Breiman Bias and robustness.
- Cluster selection and assessment criteria.
- Kernel methods and clustering.

Projection Methods and Dimension Reduction for Feature Extraction

- Principle Component Analysis PCA
- Independent Component Analysis ICA
- Probabilistic PCA
- Expectation Maximisation Algorithm
- Treating missingness in data and robust variations
- Kernel PCA
- Kernel ICA

Johnson-Lindenstauss Lemma and Compressive Sampling

- Efficient Singular Value Decompositions

Kernel Methods in Hypothesis Testing and Inference Procedures

- Maximum Mean Discrepancy Hypothesis Tests for Goodness of Fit
- Kernel Two Sample Tests
- Kernel Independence Tests
F71RA Machine Learning for Risk and Insurance 1

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<thead>
<tr>
<th></th>
<th>Mins</th>
<th>Assessment</th>
<th>Course</th>
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<tbody>
<tr>
<td>Y</td>
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<td>Examination</td>
<td>Semester 1</td>
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Re-assessment is in the next academic year