



| Teaching Guide           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                              |           |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------|-----------|
| Identifying Data         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                              | 2020/21   |
| Subject (*)              | Professional software in finance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | Code                         | 614855218 |
| Study programme          | Mestrado Universitario en Matemática Industrial (2013)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                              |           |
| Descriptors              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                              |           |
| Cycle                    | Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Year   | Type                         | Credits   |
| Official Master's Degree | 2nd four-month period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | First  | Optional                     | 6         |
| Language                 | Spanish                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |                              |           |
| Teaching method          | Face-to-face                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                              |           |
| Prerequisites            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                              |           |
| Department               | Departamento profesorado másterMatemáticas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |                              |           |
| Coordinador              | Vazquez Cendon, Carlos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | E-mail | carlos.vazquez.cendon@udc.es |           |
| Lecturers                | Calvo Garrido, María Del Carmen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | E-mail | carmen.calvo.garrido@udc.es  |           |
|                          | Fernandez Veiga, María de las Mercedes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                              |           |
|                          | Vazquez Cendon, Carlos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        | carlos.vazquez.cendon@udc.es |           |
| Web                      | www.m2i.es                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |                              |           |
| General description      | It is intended that the student knows the most used software tools in relation to the contents studied in the subject of models, as well as being able to develop their own software.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                              |           |
| Contingency plan         | <p>1. Modifications to the contents: : there are no modifications</p> <p>2. Methodologies</p> <p>*Teaching methodologies that are maintained: all methodologies are maintained</p> <p>*Teaching methodologies that are modified: there are no modifications</p> <p>3. Mechanisms for personalized attention to students: Consultation of doubts by email, videoconference system of the master, TEAMS or skype. Available to the student, setting an appointment between the student and the teacher if necessary.</p> <p>4. Modifications in the evaluation:</p> <ul style="list-style-type: none"><li>- Exercises to be solved with Python, which represent 50% of the grade.</li><li>- Exercises to be solved with MATLAB, which represent 20% of the grade.</li><li>- Exercises to be solved with Excell, which represent 30% of the grade.</li></ul> <p>*Evaluation observations: The criteria for the 2nd assessment opportunity are the same as in the 1st assessment opportunity.</p> <p>5. Modifications to the bibliography or webgraphy: there are no modifications</p> |        |                              |           |

| Study programme competences |                                                                                                                                                                                                                                                                              |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code                        | Study programme competences                                                                                                                                                                                                                                                  |
| A1                          | Alcanzar un conocimiento básico en un área de Ingeniería/Ciencias Aplicadas, como punto de partida para un adecuado modelado matemático, tanto en contextos bien establecidos como en entornos nuevos o poco conocidos dentro de contextos más amplios y multidisciplinares. |
| A2                          | Modelar ingredientes específicos y realizar las simplificaciones adecuadas en el modelo que faciliten su tratamiento numérico, manteniendo el grado de precisión, de acuerdo con requisitos previamente establecidos.                                                        |
| A4                          | Ser capaz de seleccionar un conjunto de técnicas numéricas, lenguajes y herramientas informáticas, adecuadas para resolver un modelo matemático.                                                                                                                             |



|    |                                                                                                                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A5 | Ser capaz de validar e interpretar los resultados obtenidos, comparando con visualizaciones, medidas experimentales y/o requisitos funcionales del correspondiente sistema físico/de ingeniería.                                                                                   |
| A8 | Saber adaptar, modificar e implementar herramientas de software de simulación numérica.                                                                                                                                                                                            |
| A9 | Conocer, saber seleccionar y saber manejar las herramientas de software profesional (tanto comercial como libre) más adecuadas para la simulación de procesos en el sector industrial y empresarial.                                                                               |
| B1 | Saber aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios, incluyendo la capacidad de integrarse en equipos multidisciplinares de I+D+i en el entorno empresarial.                  |
| B2 | Poseer conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación, sabiendo traducir necesidades industriales en términos de proyectos de I+D+i en el campo de la Matemática Industrial |
| B3 | Ser capaz de integrar conocimientos para enfrentarse a la formulación de juicios a partir de información que, aun siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos.                 |
| B4 | Saber comunicar las conclusiones, junto con los conocimientos y razones últimas que las sustentan, a públicos especializados y no especializados de un modo claro y sin ambigüedades.                                                                                              |
| B5 | Poseer las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo, y poder emprender con éxito estudios de doctorado.                                                                                 |

| Learning outcomes                                                                                                                     |  |                                 |                                 |
|---------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------|---------------------------------|
| Learning outcomes                                                                                                                     |  | Study programme competences     |                                 |
| Having an overview of the existing range of financial software on the market                                                          |  | AC4<br>AC8                      | BC1<br>BR1                      |
| To handle Excel for usage in the efficient resolution of some financial problems studied in the course of models                      |  | AC1<br>AC4<br>AC5<br>AC8<br>AC9 | BC1<br>BC2<br>BR1               |
| Knowing some Matlab specific tools for evaluating products and financial situations                                                   |  | AC2<br>AC4<br>AC8<br>AC9        | BC1<br>BC2<br>BC3<br>BR1        |
| Be able to produce original financial software in Matlab programming environment using appropriate financial toolboxes if necessary   |  | AC4<br>AC5<br>AC8<br>AC9        | BJ1<br>BC1<br>BC2<br>BC3<br>BR1 |
| Be able to develop financial software that requires interaction between Matlab and Excel, also using the tool ExcelLink when suitable |  | AC4<br>AC5<br>AC8<br>AC9        | BJ1<br>BC1<br>BC2<br>BC3<br>BR1 |

| Contents                                                                |           |
|-------------------------------------------------------------------------|-----------|
| Topic                                                                   | Sub-topic |
| 1. An overview of the current professional financial software toolboxes |           |
| 2. Introduction to Excell with its usage in finance in view             |           |
| 4. Excel - VBA - Matlab Interaction: Excel Link                         |           |
| 3. Specific Matlab toolboxes for finance                                |           |



|                                                                   |  |
|-------------------------------------------------------------------|--|
| 5. Software development for financial pricing in Excel and Matlab |  |
| 6. Software development for financial pricing in Python           |  |
| 7. Specific financial toolboxes in Python                         |  |

| Planning                                                                                                                        |                               |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies                  | Ordinary class hours | Student's personal work hours | Total hours |
| Problem solving                                                                                                                 | A4 A5 A9 A8 B2 B5 B3          | 0                    | 22                            | 22          |
| Guest lecture / keynote speech                                                                                                  | A1 A2 A4 A5 A9 A8 B2 B5 B1 B4 | 21                   | 0                             | 21          |
| Supervised projects                                                                                                             | A4 A5 A9 A8 B5 B3             | 0                    | 30                            | 30          |
| Problem solving                                                                                                                 | A4 A5 A9 A8 B2 B5 B3          | 4                    | 4                             | 8           |
| ICT practicals                                                                                                                  | A9 A8 B4                      | 21                   | 42                            | 63          |
| Personalized attention                                                                                                          |                               | 6                    | 0                             | 6           |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |                               |                      |                               |             |

| Methodologies                  |                                                                                                                                                                                          |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                  | Description                                                                                                                                                                              |
| Problem solving                | The student must solve some of the issues and problems that allow practice using software tools                                                                                          |
| Guest lecture / keynote speech | The use of software tools (Excel, Matlab, etc) for the solution of models and financial problems will be described, some of them studied in the course of mathematical models in finance |
| Supervised projects            | Works or projects to solve financial problems using various software toolboxes that have been discussed will be posed to the students                                                    |
| Problem solving                | Financial valuation issues to be solved by software tools as classroom exercises will be posed                                                                                           |
| ICT practicals                 | Financial examples to be solved with the computer will be posed and the commands of the different software tools will be trained                                                         |

| Personalized attention            |                                                                                                                                                                      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                     | Description                                                                                                                                                          |
| ICT practicals<br>Problem solving | Additionally to classroom questions, all questions posed by students through e-mail or during personal appointments with the professor will be individually assessed |

| Assessment          |                      |                                                                                                                                                                                             |               |
|---------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies       | Competencies         | Description                                                                                                                                                                                 | Qualification |
| Supervised projects | A4 A5 A9 A8 B5 B3    | Works or project will be posed to students, mainly consisting of solving financial problems by using the Excel (30) and Python (45) software tools that have been presented during lectures | 75            |
| Problem solving     | A4 A5 A9 A8 B2 B5 B3 | Problems about financial pricing by using the described Matlab software toolboxes will be posed to be solved in classroom                                                                   | 25            |

| Assessment comments                                                                                |
|----------------------------------------------------------------------------------------------------|
| The criteria for the 2nd assessment opportunity are the same as in the 1st assessment opportunity. |

| Sources of information |
|------------------------|
|------------------------|



|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic         | <ul style="list-style-type: none"><li>- The Math Works Inc. (2005). Financial Derivatives Toolbox User?s Guide .</li><li>- The Math Works Inc. (2005). Financial Toolbox User?s Guide.</li><li>- (). <a href="http://www.mathworks.com">http://www.mathworks.com</a>.</li><li>- Mark Lutz (2013). Learning Python. O'Really</li><li>- Hans Petter Langtangen (2009). A primer on Scientific Programming with Python. Springer</li><li>- Yves Hilpisch (2015). Python for finance. Analyze big financial data. O'Really</li><li>- Goutham Balaramen, Luigi Ballagio (2019). QuantLib Python Cookbook.</li><li>- (). <a href="http://numpy.org">http://numpy.org</a>.</li><li>- (). <a href="http://www.scipy.org">http://www.scipy.org</a>.</li><li>- (). <a href="http://www.python-excell.org">http://www.python-excell.org</a>.</li><li>- (). <a href="http://www.quantlib.org">http://www.quantlib.org</a>.</li><li>- (). <a href="http://matplotlib.org">http://matplotlib.org</a>.</li><li>- (). <a href="http://pydata.org">http://pydata.org</a>.</li></ul><br><br /> |
| Complementary |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Recommendations                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------|
| Subjects that it is recommended to have taken before                                                                                |
| Numerical methods and programming/614855201<br>Mathematical modeling in finance/614855211<br>Stochastic numerical methods/614855226 |
| Subjects that are recommended to be taken simultaneously                                                                            |
|                                                                                                                                     |
| Subjects that continue the syllabus                                                                                                 |
|                                                                                                                                     |
| Other comments                                                                                                                      |
|                                                                                                                                     |

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.