## UNIVERSITY OF EDINBURGH

College of Science and Engineering:
Taught Postgraduate Programme Proposal Form Cover Sheet

### SUMMARY INFORMATION

<table>
<thead>
<tr>
<th>Programme Title</th>
<th>MSc in Financial Modelling and Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme qualification</td>
<td>Master of Science/Diploma</td>
</tr>
<tr>
<td>Host School</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Name of proposer(s)</td>
<td>Dr Sotirios Sabanis, Dr Toby Bailey (Director of Teaching) and Dr Julian Hall (OR MSc Programme Director)</td>
</tr>
<tr>
<td>Name of intended Programme Director</td>
<td>Dr Sotirios Sabanis</td>
</tr>
<tr>
<td>Duration of study</td>
<td>Full time x months 12</td>
</tr>
<tr>
<td>(tick as applicable, and give months for FT)</td>
<td>Part time x months 24</td>
</tr>
<tr>
<td>Mode of study / delivery</td>
<td>Resident at Edinburgh University x</td>
</tr>
<tr>
<td>(tick as many as applicable)</td>
<td>Resident at another HE institution □</td>
</tr>
<tr>
<td></td>
<td>Collaborative □</td>
</tr>
<tr>
<td></td>
<td>Distance learning □</td>
</tr>
<tr>
<td></td>
<td>Flexible training package □</td>
</tr>
<tr>
<td>Date of intended first intake</td>
<td>21st September 2010</td>
</tr>
<tr>
<td>Date approved by School Board of Studies</td>
<td>9 October 2009</td>
</tr>
<tr>
<td>Approval of Head of School (signature and date)</td>
<td>(This is taken to indicate that all issue of resource have been addressed within the School)</td>
</tr>
<tr>
<td>Date submitted to College Learning and Teaching Committee</td>
<td></td>
</tr>
</tbody>
</table>

Please attach the following documents for your proposed programme:

- Programme Specification
  
  Attached
  
- Course cover sheets (for new or substantially revised courses)
  
  One new course is required (form attached)
  
- Degree Programme Table

  Included in the attached Programme Specification sheet

- Further programme information – see below
Further programme information required:
Note: If the documentation that went to the Board of Studies contains all the information requested below, then please just attach that documentation.

(a) Strategy and planning

(i) Indicate the relevance of the programme to the School plan; how it fits within any School suite of taught postgraduate courses and how it relates to active areas of research work.

- The School of Mathematics currently offers two MSc programmes, one in Financial Mathematics and one in Operational Research. The latter programme is one of the strongest in the UK and has introduced the successful idea of the "OR with" themes which provides additional flexibility to students in order to specialise further in areas such as Finance, Energy etc. The former programme is run jointly with Heriot-Watt and is one of the oldest MSc's in Financial Mathematics. Thus, the School has the expertise and the courses in place to setup this new MSc (in Financial Modelling and Optimization) which blends together two of the most popular subjects in Applied Mathematics (i.e., Financial Mathematics and Operational Research) for students that are searching for a postgraduate degree at a Masters level. In order to make this proposed degree even more attractive, we already had discussions with the (UoE) Business School and they have agreed to open some of their courses to our future students.

Only one new course is needed for the completion of the proposed programme of study. Our School's costing exercise (please see attached MS Excel file) shows that even if we had the courses (which appear on the proposed programme) running solely for the MSc in Financial Modelling and Optimization, we would have been in profit with an audience of 15 students.

Recently, our School of Mathematics has recruited a new member of staff whose area of expertise is Financial Mathematics. One of the main reasons for this recruitment was the need to expand the School’s portfolio of courses in this area since we were planning (and it has now been agreed) to take over the directorship of the MSc in Financial Mathematics. In addition, it is expected that this new arrival will significantly enhance the research profile of the School in this area. Thus, the opportunity will be given to our probability/financial mathematics group to grow through the expansion of our portfolio of MSc programmes. It is expected that the expansion of the group will be financed by the establishment and successful operation of this newly proposed MSc programme. It is also expected that as a result of this expansion, an increased number of publications in the aforementioned area of research will be achieved.

(ii) To assist with College planning, indicate how many students to you expect to admit each year (in steady state), and the recruitment profile expected whilst building up to this steady state.

Our aim initially is to have around 15 students since, as it is explained below, the issue of how the proposed programme interacts with our joint M.Sc. in Financial Mathematics is very sensitive.

The numbers for our Home/EU and Overseas students that register either for the MSc in OR (including OR with) or the MSc in Financial Mathematics in previous years (starting from 2004-5) can be found in the following table:
<table>
<thead>
<tr>
<th>Year</th>
<th>OR Students</th>
<th>Fin Maths Students</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-5</td>
<td>11.0</td>
<td>15 Home/EU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.5</td>
<td>15 Overseas</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>20.5</strong></td>
<td><strong>30 Total</strong></td>
<td></td>
</tr>
<tr>
<td>2005-6</td>
<td>12.5</td>
<td>13 Home/EU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>7 Overseas</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>27.5</strong></td>
<td><strong>20 Total</strong></td>
<td></td>
</tr>
<tr>
<td>2006-7</td>
<td>13.5</td>
<td>7 Home/EU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.0</td>
<td>4 Overseas</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>40.5</strong></td>
<td><strong>11 Total</strong></td>
<td></td>
</tr>
<tr>
<td>2007-8</td>
<td>14</td>
<td>7 Home/EU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>10 Overseas</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>43</strong></td>
<td><strong>17 Total</strong></td>
<td></td>
</tr>
<tr>
<td>2008-9</td>
<td>23</td>
<td>11 Home/EU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>18 Overseas</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>51</strong></td>
<td><strong>29 Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note that the leading institution during the above period 2004-9, and also in charge of admissions, for the jointly run Financial Mathematics MSc, was Heriot-Watt University. However, the directorship will be taken over by the University of Edinburgh starting from the next academic year 2010-11. It is expected that as a result of this change the number of applications will increase significantly since the UoE brand is more attractive to the applicants. It is also expected that the FMO MSc distribution of applications will follow the pattern of the other two MSc programmes, i.e. the number of overseas applicants will be higher than the corresponding Home/EU number.

Finally, we anticipate no significant impact on the OR MSc numbers from the establishment of this new MSc mainly for two reasons:

(a) applicants must have stronger mathematical background in order to be allowed in the FMO programme (note that only a small number of OR MSc students each year expresses an interest in attending the Stochastic Processes courses which are the core courses in Financial Mathematics MSc that are taught by UoE staff);

(b) FMO MSc will have a higher fee.

It is expected that the total number of students for the two programmes would be significantly higher than the current intake on the OR MSc. When combined with the increase in average fees this should lead to a substantial increase in income.
(b) Fees

(i) Tuition fees
Indicate the level of tuition fee proposed - for both home and overseas students.

We propose that the fees be set at the level of £10,500 for Home/EU and £13,000 for Overseas students which is the same as our joint Financial Mathematics M.Sc. with Heriot-Watt. The reasons for this are as follows. Firstly, Financial Mathematics is a substantial part of the proposed programme and in that area fees for domestic students are commonly at around this level rather than the lower levels of the College's normal fee bands. Secondly, the issue of how the proposed programme interacts with that joint M.Sc. is very sensitive. We do not wish to compromise that collaboration by undercutting the joint M.Sc., but equally we wish to make it an attractive alternative. We feel strongly after some consideration that the only sensible course in the short term is for the pricing to be identical.

Finally, one may observe that the success of Financial Mathematics MSc programmes across the UK has led to the creation of similar MSc programmes with more computational nature. A few examples follow:

1) Oxford: An MSc in Mathematical Finance exists along with an MSc in Mathematical and Computational Finance. The tuition fees for the latter are given below:

17,000 GBP + 2,000 GBP for Home/EU and 17,000 GBP + 2,000 GBP for Overseas students.

2) LSE: An MSc in Financial Mathematics exists along with an MSc Risk and Stochastics. The tuition fees for the latter are given below:

19,224 GBP Home/EU & 19,224 GBP Overseas

3) Leeds: An MSc in Financial Mathematics exists along with an MSc in Statistics with Applications to Finance. The tuition fees for the former* are given below:

Fees: 7,800 GBP Home/EU, 13,000 GBP Overseas

[*The fees for the latter programme are not available from the relevant website]

(ii) Other programme costs
None.

(c) Programme Structure

The structure of the programme does not differ from the standard curricula models.

(d) Collaboration

The programme will not involve any other Institution.
PROCEDURES FOR SUBMISSION OF PROPOSAL

The completed proposal, containing all the information requested above, should be sent in electronic format to: lynda.m.henderson@ed.ac.uk

Note: Lynda Henderson is the Secretary to the College Learning and Teaching Committee. The dates of the meetings of that Committee are available on the College web site: http://www.scieng.ed.ac.uk/Admin/Committees/Index.asp

Lynda Henderson would be pleased to receive draft versions of the proposal to provide you with informal comment and advice prior to a formal submission. Sources of advice to assist you in the development of the proposal are contained in the Appendix.
APPENDIX: SOURCES OF ADVICE AND INFORMATION

If you wish advice or further information on any aspect of the preparation or submission of a new MSc programme proposal, please contact the people below:

**Business Plans and Resource Information**

Mr Terry Fox, College Accountant; 505991; Terence.fox@ed.ac.uk

Mr Jim Galbraith; College Management Information & Planning Support; 507529; Jim.Galbraith@ed.ac.uk

The College Office has developed a spreadsheet to assist Schools in the financial modelling of the development of new programmes. A template and guidance notes for completing the spreadsheet can be obtained from http://www.scieng.ed.ac.uk/admin/procedures/mscdev/

**Regulations, programme structure and fees**

Lynda Henderson; Administrative Officer, Academic Affairs Section, College Office; 505765; Lynda.M.Henderson@ed.ac.uk

**Strategy**

Dr Nick Hulton (Dean of Learning and Teaching); Nick.Hulton@ed.ac.uk

Prof Nigel Seaton (Assistant Principal, Taught Programme Development); nigel.seaton@ed.ac.uk

**Market information**

Communications and Marketing; 51 4158; john.cavani@ed.ac.uk

Admissions Officers, Recruitment and Admissions, College Office; 50 5755; SCE.Admissions.Offer@ed.ac.uk

International Office: enquiries.international@ed.ac.uk

Student Recruitment & Admissions; 50 4360; sra.enquiries@ed.ac.uk

Careers Service (King's Buildings); 50 5773; careers@ed.ac.uk
THE UNIVERSITY OF EDINBURGH

PROGRAMME SPECIFICATION FOR M.Sc. in Financial Modelling and Optimization

1) **Awarding Institution:** University of Edinburgh
2) **Teaching Institution:** University of Edinburgh
3) **Programme accredited by:** n/a
4) **Final Award:** Master of Science
5) **Programme Title:** MSc in Financial Modelling and Optimization
6) **UCAS Code:** Relevant QAA Subject Benchmarking Group(s): QAA 212
7) **Postholder with overall responsibility for QA:** Head of School of Mathematics
8) **Date of production/revision:** 9 October 2009
9) **Educational aims of programme:**

   The main purposes of the programme are to:

   - provide rational, flexibly structured and coherent programmes of study which are relevant to the needs of employers in areas of industry such as the financial sector, energy market and any other area where modern financial tools and optimization techniques are used;
   - facilitate the professional development of students (with a strong mathematical background) in the theory and practice of financial mathematics and optimization and lay the foundations for a successful career to the benefit of the economy and society;
   - provide a sound knowledge base in the fields studied and develop the wider process skills of Problem Solving (through the application of advanced mathematical techniques from the areas of Modern Probability Theory, Stochastic Analysis and Optimization), Team Working and Time/Task Management;
10) Programme Outcomes:

(a) Knowledge and understanding


2. **Core Operational Research**: Mathematical and computational foundations of OR. Modelling practical decision problems. Risk management. Computational optimization. Application areas such as finance, telecommunications, energy and data mining.


A. Teaching/learning methods and strategies

Acquisition of knowledge is achieved mainly through lectures and projects. In all courses understanding is reinforced through tutorial/example-class work.

B. Assessment methods and strategies

Assessment methods are specified in each course guide. All learning outcomes in a course are assessed and the mode of assessment is specified for each outcome. In general, each course is assessed by a combination of end of semester examination and/or coursework. The nature of the coursework varies from course to course.

(b) Intellectual skills

The ability to:

1. Integrate theory and practice.

2. Construct and develop logical mathematical arguments with clear identification of assumptions and conclusions.

3. Apply advanced mathematical techniques from Modern Probability Theory to solve complex problems in Derivative Pricing.

4. Formulate and test hypotheses.

5. Apply Operational Research principles to the solution of real-life decision problems.

6. Analyse and solve portfolio optimization problems.

7. Demonstrate the skills necessary to plan, conduct and report a programme of original research.
(c) Professional/subject-specific/practical skills

1. Ability to price complicated financial products.
2. Apply and critically evaluate the applications/limitations of modern techniques for derivative pricing and portfolio optimization.
3. Use advanced theories and concepts to explain the nature and properties of randomness that drives the values of financial products and indices.

(d) Transferable skills

1. Capacity to learn in familiar and unfamiliar situations.
2. Communicate effectively by written or verbal means.
3. Numerical and problem solving skills appropriate to a financial mathematician.
5. Able to work as part of a team.
6. Able to work independently.
7. Project planning and time/task management skills.

11) Programme Structure and Features:

The programme is offered in full-time (12 months) and part-time (24 months) study modes. All learners take courses to the value of 120 points and must study a number of compulsory course units (90 points). Another 60 points are achieved through the successful completion of an MSc dissertation during the summer months. The remaining programme is constructed from optional course units, chosen by the learner in consultation with their tutors.

Courses:

A. Compulsory

1. [P03521] Discrete-Time Finance (15 points, S1)
2. [P03522] Stochastic Analysis in Finance I (7.5 points, S1)
3. [P00713] Mathematical Programming (10 points, S1)
4. [P00704] Dynamic & Integer Programming (10 points, S1)
5. [P00233] Investment Mathematics (10 points, S1)
6. [P03541] (new course) Asset Pricing (10 points, S2)
7. [P03523] Stochastic Analysis in Finance II (7.5 points, S2)
8. [U01890] Simulation (10 points, S2)
9. [P00727] Stochastic Modelling (10 points, S2)
10. MSc dissertation (60 points, summer period)

B. Optional

1. [P00717] Nonlinear Optimization (10 points, S1)
2. [P02375] Financial Model Building (5 points, S1)
3. [P00701] Continuous Global Optimization (5 points, S1)
4. [P03542] (new course code*) Research-Linked Topics (5 points, S1-2)
5. [P00709] Large Scale Optimization (10 points, S2)
6. [P00702] Credit Scoring and Data Mining (10 points, S2)
7. [P01815] Financial Risk Management (10 points, S2)
8. [P01816] Risk Analysis (5 points, S2)
9. [P00242] Financial Econometrics and Quantitative Techniques (10 points, S2)
10. [P00728] Stochastic Optimization (5 points, S2)
11. [P00699] Combinatorial Optimization (5 points, S2)

* This course will be a subset of the combined version of the Financial Mathematics MSc courses P02979 and P02980.

12) Other items:

None
# Financial Modelling and Optimization (MSc/Dip)

<table>
<thead>
<tr>
<th>NYT</th>
<th>Course</th>
<th>S</th>
<th>L</th>
<th>CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Discrete-Time Finance</td>
<td>P</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Stochastic Analysis in Finance I</td>
<td>P</td>
<td>11</td>
<td>7.5</td>
</tr>
<tr>
<td>8</td>
<td>Mathematical Programming</td>
<td>P</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>Dynamic and Integer Programming and Game Theory</td>
<td>P</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Investment Mathematics</td>
<td>P</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Asset Pricing</td>
<td>P</td>
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<td>10</td>
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<tr>
<td>12</td>
<td>Stochastic Analysis in Finance II</td>
<td>P</td>
<td>11</td>
<td>7.5</td>
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<tr>
<td>13</td>
<td>Simulation</td>
<td>P</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>14</td>
<td>Stochastic Modelling</td>
<td>P</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>Dissertation (FMO)</td>
<td>P</td>
<td>11</td>
<td>60</td>
</tr>
<tr>
<td>16</td>
<td>Optional courses from Collection *</td>
<td>P</td>
<td>11</td>
<td>30</td>
</tr>
</tbody>
</table>

* Collection:
- Nonlinear Optimization (10 credits)
- Financial Model Building (5 credits)
- Continuous Global Optimization (5 credits)
- Research-Linked Topics (5 credits)
- Large Scale Optimization (10 credits)
- Credit Scoring and Data Mining (10 credits)
- Financial Risk Management (10 credits)
- Risk Analysis (5 credits)
- Financial Econometrics and Quantitative Techniques (10 credits)
- Stochastic Optimization (5 credits)
- Combinatorial Optimization (5 credits)
- Operational Research in the Energy Industry (5 credits)
College of Science and Engineering

Notification of new / changed courses for approval

New courses, or major changes to existing courses should be entered by the School via the Course Creation, Approval and Maintenance (CCAM) facility in WISARD: http://www.registry.ed.ac.uk/wisard/default.htm

After entering the details in WISARD and after approval by the Board of Studies, the School should complete this pro-forma and send it to the College Office: lynda.m.henderson@ed.ac.uk

This proforma is used by the College Office to alert the Committee Secretary that courses are awaiting approval at College level, and to provide a background to the discussion at the College Learning and Teaching Committee.

Name of School: Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Undergraduate or Postgraduate</th>
<th>New course or change to existing course</th>
<th>What other Schools have been consulted on this proposal?</th>
<th>Any issues of concern raised by BoS or those consulted</th>
<th>SCQF Level</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>P03541</td>
<td>Asset Pricing</td>
<td>P</td>
<td>New</td>
<td>n/a</td>
<td>None</td>
<td>11</td>
<td>10</td>
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<tr>
<td>P03542</td>
<td>Research-Linked Topics</td>
<td>P</td>
<td>New - but a sub-set of P02979 and P02980.</td>
<td>n/a</td>
<td>None</td>
<td>11</td>
<td>5</td>
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<tr>
<td>P00302</td>
<td>Simulation</td>
<td>P</td>
<td>Existing - see note below. *</td>
<td>n/a</td>
<td>None</td>
<td>11</td>
<td>15 *</td>
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<tr>
<td>P03548</td>
<td>Dissertation (FMO)</td>
<td>P</td>
<td>New</td>
<td>n/a</td>
<td>None</td>
<td>11</td>
<td>60</td>
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</tbody>
</table>

* This postgraduate course should be 15 points, not 7.5 as on WISARD. It is essentially the same course as U01890 (10 points), but includes a project worth 40% of entire course.