Engineering Tripos Part IIB, 4I1: Strategic Valuation, 2020-21

Module Leader
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Lecturer
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Lab Leader
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Timing and Structure
Christmas vacation - dates below; Assessment: Coursework 100% in project combining spreadsheet modelling, written analysis and a management-style report - details TBA. You may conduct some Excel modelling with fellow students. Michaelmas/Lent Term break.

Prerequisites
All participants are expected to be familiar with probability and statistics at the level of a final year high school or introductory undergraduate course. See the prerequisites document on the course website for details. Participants are also expected to be familiar with basic Excel spreadsheet modelling (see e.g. http://best-excel-tutorial.com/54-basics for a tutorial). The basic Excel functions and tasks that you must know how to use competently are: MAX, AVERAGE, COUNT, IF, SUMPRODUCT; mathematical formulas based on relative and absolute references; creating simple tables; plotting pie, bar, column and line charts.

Aims
The aims of the course are to:

- See below.

Objectives
As specific objectives, by the end of the course students should be able to:

- See below.

Content
- Module Time: 3 full days (9.00am – 5.00pm) on 7th, 9th, and 11th December 2020.
- Reserve 7th – 14th December 2020 for TPE25 ONLY.
- Reserve 12th and 13th December 2020 for conducting part I of the course assessment.
- Reserve a compulsory Q&A session for the course assessment from 13:30 until 15:30 on 14th December 2020.
- There is a possibility that this course will be delivered online depending on when the Covid19 social
distancing rules will be removed.

- It is necessary for you to have a Window-based laptop for Excel modelling although it is possible that a Mac-based laptop can be used for Excel modelling. If this course is delivered in classroom and Cambridge, then there is a possibility that students use computers in the computer lab. In the latter, if you do not have a laptop, be prepared to stay in Cambridge for a few more days after 16th December 2020 so that you can conduct Excel modelling in relation to your course assessment in the CJBS Computer Lab – subject to availability of the lab.
- The level of mathematical theory may be below the expectation of some CUED students.

This module introduces students to two essential and complementary ways of dealing with future uncertainties. On one hand, we have diversification, the notion that you should "not put all your eggs in one basket", is both intuitive and ubiquitous in modern management. This exemplifies passive risk management. On the other, we have the real options paradigm. This emphasises that future value depends both on unfolding uncertainties, which you cannot control, and the flexibility of your future responses. By investing in research and development projects, for example, companies buy the option to launch a product, which they may or may not exercise, depending on the level of success of the R and D effort and on market conditions at the time of launch. However, flexibility also costs money: R and D expenditure, for example in the biotech industry, can be huge. So how much flexibility shall we build into the system? This is the realm of project design for active risk management. System designers and project managers need tools that help them decide if added flexibility is worth the money. This course provides the students with a mindset and a suite of tools to tackle such problems.

The emphasis is on management and design of technological projects. Examples and case studies will illustrate how theory can be adapted to actual conditions.

Please note that the number of places available to Part IIB Engineers is limited. A ballot will be held if the module looks likely to be oversubscribed. The ballot will take place on the first day of lectures, after which the Teaching Office will be in touch with any unsuccessful applicants to ask them to select another module.

**Day 1: Foundations**

- Course aims and objectives
- Review of traditional project valuation
- System value is a shape, not a number
- Monte Carlo Simulation
- (Valuing flexibility)

Preparatory reading:

- de Neufville, R. and Scholtes, S. (2011), Ch 2: "Recognition of Uncertainty".
- If you have not seen Net Present Value (NPV) or Discounted Cash Flows before, read Brealey and Meyers, Ch. 2: ‘Present values’.

**Day 2: Portfolio Thinking**

- Diversification
- Hedging
- Trading off risk against return

Preparatory reading:

- [www.moneychimp.com/articles/risk/riskintro.htm](http://www.moneychimp.com/articles/risk/riskintro.htm) [2], first five sections (short!) from ‘MPT Introduction’ to ‘Build a Portfolio’.
- Optionally, Brealey and Meyers, Ch. 9: ‘Risk’ [For 8th edition, use Ch. 8]
Day 3: Real Options Analysis

- Flexibility: Intuition behind real options
- Lattice valuations

Preparatory reading:

- Brealey and Meyers, Ch. 10: ‘Project Analysis’, Ch. 20: ‘Understanding Options’ [For the 9th edition, use Ch. 11, Ch. 21]
- de Neufville and Scholtes (2011), Ch. I: ‘High Level Overview’ (pp. 1-39)

Further notes

Required software

The basic modelling tool will be Microsoft Excel. Essential add-ins include Analysis ToolPak and Solver, both of which come with Excel but may require the Excel installation disks, and @Risk, which will be distributed to you.

Coursework

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<th>Coursework</th>
<th>Format</th>
<th>Due date &amp; marks</th>
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<td>100% individual project combining spreadsheet modelling, written analysis and a management-style report. The coursework consists of two parts: Task I (65%-70%) and Task II (30%-35%). Task I contains a number of subtasks, in which students are asked to conduct intensive Excel modelling, to answer questions, to provide analysis, and to give intuitive business interpretations. Task II is a short presentation and is assessed by a set of criteria: intuition (business implication), prioritising information (structure), clarity and use of visual aids such as charts and graphs, and language.</td>
<td>Individually Assessed Answer Sheet, Presentation Document and Excel Files Anonymously marked</td>
<td>The coursework will be carried out during Michaelmas/Lent term break and will be submitted right before the beginning of the Lent term in January 2021. Marks will be available in three-four weeks after the submission date.</td>
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Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Module Webpage

To be advised: [https://www.vle.cam.ac.uk](https://www.vle.cam.ac.uk) [3]

TPE25 Strategic Valuation

Reference Books

The following are available in multiple copies in the Judge Business School Information Centre:

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<tr>
<td>de Neufville, R. and Scholtes, S. (2011)</td>
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<tr>
<td><strong>Flexibility in Engineering Design.</strong> Cambridge, MA: MIT Press</td>
</tr>
<tr>
<td>E-book: <a href="https://ebookcentral.proquest.com">https://ebookcentral.proquest.com</a></td>
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or

9th ed.

N.B. For Brealey and Myers, any edition from 6th ed. onwards is fine.


Examination Guidelines

Please refer to Form & conduct of the examinations [6].

UK-SPEC

The UK Standard for Professional Engineering Competence (UK-SPEC) [7] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the ‘Accreditation of Higher Education Programmes’ (AHEP) document [8] which sets out the standard for degree accreditation.

The Output Standards Matrices [9] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.