University of Dublin
Trinity College

School of Computer Science and Statistics

Management Science
and
Information Systems Studies
Information Booklet for Junior Sophister Students

2014/2015
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PART I - Information

1. Welcome

Welcome back. I hope you had a good break. Congratulations on getting through SF.

If you have any queries during the year you are welcome to drop into my office in Room 1.32 in the Lloyd Institute or email me at aideen.keaney@tcd.ie.

I wish you every success in the coming year.

Aideen Keaney
Course Director, MSISS.

2. A Note on this Handbook

This handbook contains information and regulations for Junior Sophister students on the BA (Mod) Management Science and Information Systems Studies in the 2014-15 academic year. Please retain it for future reference.

Information provided in this handbook is accurate at time of preparation. Any necessary revisions will be notified by college email. Please note that, in the event of any conflict or inconsistency between the General Regulations published in the University Calendar and information contained in course handbooks, the provisions of the General Regulations will prevail. The University Calendar is available at

http://www.tcd.ie/calendar/

This handbook is also available from the School of Computer Science and Statistics website at

https://www.scss.tcd.ie/assets/resources/msiss-handbook-js.pdf

It is strongly recommended that you keep this booklet safely. You may need to refer to it during the year.
3. General Information

3.1. Term Dates

The following table lists the duration of each term and the start and end dates for teaching in each term for the 2014-15 academic year. No lectures are held during the reading weeks in each term.

<table>
<thead>
<tr>
<th>Term</th>
<th>Duration</th>
<th>Start and End Dates (2014-15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michaelmas Term</td>
<td>12 weeks</td>
<td>22\textsuperscript{nd} September 2014 – 12\textsuperscript{th} December 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Reading Week: 3\textsuperscript{rd} November – 7\textsuperscript{th} November 2014)</td>
</tr>
<tr>
<td>Hilary Term</td>
<td>12 weeks</td>
<td>12\textsuperscript{th} January 2015 – 3\textsuperscript{rd} April 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Reading Week: 23\textsuperscript{rd} February – 27\textsuperscript{th} February 2015)</td>
</tr>
</tbody>
</table>

Annual examinations will take place from 27\textsuperscript{th} April to 22\textsuperscript{nd} May 2015. Examination dates will be posted on the College web site in due course. **It is the student’s responsibility to determine dates, times and locations of examinations.**

3.2. Contact Information

BA (Mod) Management Science and Information Systems Studies Administration

Course Director            Dr Aideen Keaney            aideen.keaney@tcd.ie
Course Administrator       Gillian Long          Gillian.Long@scss.tcd.ie
3.2.1. The MSISS Library

MSISS has its own library. Undergraduates have full access and some borrowing rights from the library and students are encouraged to make use of it. This library holds MSISS core texts and Final Year project reports, is in Statistics Reception, Room 1.04. The core texts are those recommended for certain MSISS modules.

Undergraduates may borrow these books and project reports under the following conditions:

- They must be checked out by Gillian Long, who will make a note of your student ID number.
- A maximum of three core texts can be borrowed at any time.
- Once checked out, you have the right to the book for one week. After that time, you may be asked to return the book if it is requested by another student. This request will come by e-mail. Otherwise there is no borrowing time limit during term time (see below).

All projects and books must be returned before the end of Trinity Term. Please do not remove books from libraries - even for temporary periods.

3.3. Dealing with Problems

If you have problems, it saves you and us a great deal of hassle if they are directed to the right source. In general enquiries should be directed as follows:

3.3.1. Personal Problems

Most matters including all personal problems and/or requests for special treatment (e.g. seeking permission to take a year off, obtaining details of your examination marks or appealing an examination result) should be taken to your tutor, whose job it is to help you. Going to other staff members or the course administrator will only result in your being re-directed. If your tutor cannot be found, you should approach one of the other tutors or in an emergency, the Senior Tutor.

3.3.2. Administrative Matters

Administrative matters (e.g. replacement of lost timetables or requests for transcripts) should be addressed to Gillian Long Gillian.Long@scss.tcd.ie or to teaching-unit@scss.tcd.ie.
3.3.3. Academic Matters

Academic issues (e.g. “I don’t understand this”, “Can we arrange a revision class?”) should be taken to the lecturer concerned. Lecturers are here to help you. **If you are in difficulties you should ask for help.** Be aware however that lecturers are generally only willing to help students who attend lectures regularly (unless the students concerned are absent for some genuine reason). Many academic staff, including the Director of Studies, have ‘office hours’, i.e. times when they are available in their rooms to meet students without a prior appointment. These are usually posted on their office door. It is helpful to staff if a problem can wait until one of these times.

Programme or wider course issues (e.g., books are not available in the library, you can’t hear a certain lecturer because he/she does not speak clearly) should be taken to the class representative who should in turn take them up with the Director of Studies, Aideen Keaney. If in doubt, speak to your tutor first.

3.3.4. Programming Centre

The Programming Centre is available to all MSISS students free of charge. The centre operates as a drop-in service where you can get help with any problems you might have with programming in your courses. For further information, please visit [http://www.scss.tcd.ie/misc/psc/](http://www.scss.tcd.ie/misc/psc/)

3.3.5. Study Skills

Skills4studycampus (S4SC) is an interactive e-learning resource, designed to enable students to develop study skills and is suitable for students on all courses and in any year of study. The system was tested in a pilot project in Trinity last year, and is now available via the skills4studycampus link on the college's local home page, [http://www.tcd.ie/local](http://www.tcd.ie/local)

3.3.6. Students with Disabilities

If you have a general or a specific learning disability (such as dyslexia) you may want to register with Student Disability Services. A variety of supports are available to disabled students within the College. Further information on these services can be found at [http://www.tcd.ie/disability/](http://www.tcd.ie/disability/)

You can make an appointment to see staff of Student Disability Services:

- By Phone: (01) 896 3111
- By Text (Deaf Students): 086 3442322
- By Email: disab@tcd.ie
- On the website
- Or, by calling into the office (Room 2054, The Arts Building).
3.3.7. Other Sources of Support and Help in College

- Student Counselling Service – 3rd Floor 7-9 South Leinster St., Tel: 01 896 1407, or email: student-counselling@tcd.ie. Emergency appointments are available. This service is confidential and free to students. See http://www.tcd.ie/Student_Counselling/

- Chaplains - House 27, chaplaincy@tcd.ie. Tel: Peter Sexton and Paddy Gleeson : 01 896 1260; Julian Hamilton : 01 896 1901 and Darren Mc Callig at 01 896 1402. The Chaplains run a Bereavement Support Group for those who have experienced loss. The Chaplains will also help you make contact with other religious communities in Dublin. See http://www.tcd.ie/Chaplaincy/index.htm

- College Health Service - House 47 (beside the rugby pitch), Tel: 01 896 1556. Appointments may be made in person or by telephone. This service is free to most students. http://www.tcd.ie/College_Health

- College Tutors and Senior Tutor’s Office, House 27. Tel: 01 896 2551. stosec@tcd.ie. You can find your tutor’s name and contact number through the my.tcd.ie portal.

- Welfare Officer, Students’ Union, House 6, College 01 646 8437, welfare@tcdsu.org;

- Niteline - A confidential help-line for students run by students is available during term-time, by telephone between 9pm and 2.30am from Thursday to Sunday at 1800 793 793 and on Mondays from 9pm to 1.30am.

### REMEMBER

*If you are in difficulties of any sort, seek help as soon as possible. The staff and College support services are here to help you.*
PART II - Regulations

4. Overview of Regulations

This part of the Course Handbook sets out the examination regulations that apply to the BA (Mod) Management Science and Information Systems Studies in the 2014-15 academic year.

The College Calendar, which is published annually at the beginning of each academic year, contains the following additional regulations:

- **General Regulations** that apply to all degree programmes in the University;
- **General Faculty Regulations** that apply to courses within the Faculty of Engineering, Mathematics and Science;
- **Regulations that apply specifically to the Moderatorship in Management Science and Information Systems Studies**.

If any discrepancy exists between the regulations in this document and the College Calendar, the College Calendar takes precedence.

The Calendar is available online at [http://www.tcd.ie/calendar/part1/](http://www.tcd.ie/calendar/part1/)

You are expected to be aware of the various regulations. Ignorance of the regulations is not a valid reason for failure to comply.

4.1. Rules for Handing in in-term Assessments

Many MSISS modules include an element of continuous assessment. Different departments have their own rules on assessments and homework. You should make sure that you are familiar with these rules and that you understand them. The MSISS rules for handing in and marking of assessments are summarised below.

1. Unless otherwise stated, the deadline for all MSISS continual assessment work will be 12.00 noon on a Monday. The Lecturer-in-Charge must give written or e-mail notice of alternative deadlines. Where non standard procedures apply, (s)he must also give written or e-mail notice of:

   - the deadline;
   - where and how assessments are to be handed in;
   - the penalties for late submission;
   - the procedures for granting permission for late submissions.

Otherwise the default rules as set out below will apply.
2. The default procedure for assignment submission is as follows.

All module work must be handed in to the School office. When handing in an assignment or project, you must sign the "Student Assessment Sign-in" sheet in the presence of the course administrator. The date and time the assessment is handed in is noted on this sheet. Assessments must be clearly labelled and show:

- Your name;
- The correct description of the assignment (e.g. Applied Prob. Exercise 3);
- The name of the appropriate lecturer.

At the end of the week, the tray will be cleared and all assignments and the sign-in sheet will be handed to the lecturer.

If the office is closed you should put your assignment in the box provided and sign the sign-in sheet. Clearly write your name, the name of the assignment, the name of the lecturer, and the time you signed in.

3. **Penalties** for late submission are as follows. Material submitted late will be down marked 20% of the mark that would otherwise have been awarded for each day (or part thereof) that it is late. Thus work that is late at all will incur a penalty of 20%, work submitted more than 24 hours late will incur a penalty of 40% and so on. Work submitted more than 96 hours late will receive a mark of zero. For MSISS this means that work submitted after 12.00 noon on the Friday of the relevant week will receive a mark of zero.

4. **Extensions** are normally granted only if you can present a good reason for not being able to submit on time. If you need an extension you should speak to your tutor not to the Lecturer. Lecturers will normally grant you an extension following a letter from your tutor who must ask for a specified number of days extension. Tutors will only recommend extensions if the difficulties could not have been foreseen.

Sometimes, where there is a general problem, a Lecturer may award an extension to the entire class. In this case, the details of the extension will be posted or e-mailed to all students. The penalty will operate as before, after the extension. If the assessment in question is a team project, and the extension is sought - through the tutor - by one team member, the maximum extension that can be given is 1 week.

5. **You should always retain a copy of everything submitted in case of dispute; a paper copy is recommended.** If kept in electronic form, you should have a backup copy. This is important. If, for example, a Lecturer says he/she never received your submission and you do not have a copy, it may be difficult to prove that you ever submitted it!

6. If you have really exceptional problems (for example, your tutor is ill), you should speak to the Director of Studies.
4.2. Teamwork Assessment

During your time in MSISS you will be required to work in teams and prepare assessments which will be graded and contribute to your final examination results. Your attention is drawn to the following regulation, instituted in an effort to be equitable to all team members:

“In the case of project work conducted by teams, the work of each team will be assessed as a team. Individual students’ assessment grades will be based primarily on the team assessment grade. In addition, students may be asked to submit an individual report on perceived contributions, per cent, of all team members. Adjustments to individual grades may be made in the light of these reports. In the event of discrepancy, the lecturer may consult some or all group members.”

4.3. Plagiarism

Students should be aware of the University's policy regarding plagiarism. Plagiarism is interpreted by the University as the act of presenting the work of others as one's own work, without acknowledgement. Plagiarism is considered as academically fraudulent, and an offence against University discipline. The University considers plagiarism to be a major offence, and subject to the disciplinary procedures of the University. Plagiarism can arise from deliberate actions and also through careless thinking and/or methodology. The offence lies not in the attitude or intention of the perpetrator, but in the action and in its consequences. Plagiarism can arise from actions such as:

(a) copying another student's work;

(b) enlisting another person or persons to complete an assignment on the student's behalf;

(c) quoting directly, without acknowledgement, from books, articles or other sources, either in printed, recorded or electronic format;

(d) paraphrasing, without acknowledgement, the writings of other authors.

Examples (c) and (d) in particular can arise through careless thinking and/or methodology where students:

(i) fail to distinguish between their own ideas and those of others;

(ii) fail to take proper notes during preliminary research and therefore lose track of the sources from which the notes were drawn;

(iii) fail to distinguish between information which needs no acknowledgement because it is firmly in the public domain, and information which might be widely known, but which nevertheless requires some sort of acknowledgement;

(iv) come across a distinctive methodology or idea and fail to record its source.
All the above serve only as examples and are not exhaustive. Students should submit work done in co-operation with other students only when it is done with the full knowledge and permission of the lecturer concerned. Without this, work submitted which is the product of collusion with other students may be considered to be plagiarism.

It is clearly understood that all members of the academic community use and build on the work of others. It is commonly accepted also, however, that we build on the work of others in an open and explicit manner, and with due acknowledgement. Many cases of plagiarism that arise could be avoided by following some simple guidelines:

(i) Any material used in a piece of work, of any form, that is not the original thought of the author should be fully referenced in the work and attributed to its source. The material should either be quoted directly or paraphrased. Either way, an explicit citation of the work referred to should be provided, in the text, in a footnote, or both. Not to do so is to commit plagiarism.

(ii) When taking notes from any source it is very important to record the precise words or ideas that are being used and their precise sources.

(iii) While the Internet often offers a wider range of possibilities for researching particular themes, it also requires particular attention to be paid to the distinction between one's own work and the work of others. College regulations on Plagiarism can be found in the College Calendar, Section H70-78: General Regulations and Information or online at:

http://www.tcd.ie/calendar/assets/pdf/general_information.pdf

We reserve the right to use plagiarism detection technology to investigate suspicions of plagiarism.
4.4. Research Ethics

Any research project that involves human participation conducted through this course (for example, a questionnaire or survey, or system user-evaluation, etc.) must have independent review by a Research Ethics Committee before its commencement.

Individual applications are considered on their own merits. A basic principle is that prospective participants should be fully informed about the research and its implications for them as participants, with time to reflect on the possibility for participation prior to being asked to sign an informed consent form. Informing prospective participants fully includes declaring potential conflicts of interest that the researcher may have in conducting the research, detailing how participants may withdraw data associated with their participation from further analysis within the study, explaining the preservation of their anonymity within the study, warning them about potential consequences of discovery during the study of issues that would necessarily have precedence over assurances of anonymity, and so on.

Application forms, with guidelines, can be found here:

https://www.scss.tcd.ie/Local/research_unit/ethics/

The Research Ethics Committee will consider each application and normally provide a response within two weeks but not more than one month later.

It takes time to prepare an application for research ethics approval, to have the application considered, and to respond to feedback on the application where issues are raised. You should plan in your work for the time it takes to obtain research ethics approval.

To apply for research ethics approval, you should email your application to research-ethics@scss.tcd.ie. You will not receive an automated acknowledgement that your application has been received (therefore, you can be certain that when you receive mail about your application, it has been addressed).

All applications must be reviewed and signed by the research Supervisor or Principal Investigator on the project. This signature confirms an assertion that the application is complete in terms of its formal requirements; it does not stand as proxy for ethical approval. Forms which are not signed or presented to an acceptable standard (e.g.: incomplete; excessive typographical or grammatical errors) will be returned and may therefore incur delays for the researchers involved.

Retrospective approval will not be granted.

Please also note, research conducted in the School of Computer Science and Statistics should be undertaken with cognisance of the TCD Guidelines for Good Research Practice.

http://www.tcd.ie/about/policies/assets/pdf/TCDGoodResearchPractice.pdf
4.5. Examination Regulations – Junior Sophister

To rise from one year to the next year of the programme, Junior Sophister students must satisfy their examiners subject to the regulations set out in this section.

1. The examinable subjects are as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST3001</td>
<td>Software Applications III</td>
<td>10</td>
</tr>
<tr>
<td>ST3002</td>
<td>Statistical Analysis III</td>
<td>5</td>
</tr>
<tr>
<td>ST3004</td>
<td>Research Methods</td>
<td>5</td>
</tr>
<tr>
<td>ST3005</td>
<td>Information Systems</td>
<td>5</td>
</tr>
<tr>
<td>ST3010</td>
<td>Applied Forecasting</td>
<td>5</td>
</tr>
<tr>
<td>ST3011</td>
<td>Multivariate linear analysis (MLA)</td>
<td>5</td>
</tr>
<tr>
<td>ST3008</td>
<td>Management Science Case Studies</td>
<td>10</td>
</tr>
<tr>
<td>CS3012</td>
<td>Software Engineering</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Option</td>
<td>10</td>
</tr>
</tbody>
</table>

These are examined during the annual examination period.

The mark in each subject is generally a combination of an exam mark and a coursework mark, but some courses, for example ST3001 and ST3008 are assessed by coursework only. The method which is used to combine exam and assignment marks into the overall mark is at the discretion of the course lecturer. In some courses to pass students must pass BOTH the written examination AND the coursework component. Students should make themselves aware of the rules governing assignments at the beginning of each course.

2. The overall average mark in the annual examination will be a weighted average of each modules mark. The weights used will be the ECTS value for each subject.

3. To pass candidates must achieve a mark of 40% or more in each of the subjects.
4. Candidates may also pass by compensation if and only if:

- They achieve an overall average mark of 40% or more and either;
  - pass modules totalling 55 credits, and get a minimum mark of 30% in the failed module
  - or
  - pass modules totalling 50 credits, and get a minimum mark of 35% in the failed module(s) (either one 10-credit module or two 5-credit modules).

5. A grade based on the overall average mark will be returned for students who pass as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>70%-100%</td>
</tr>
<tr>
<td>II.1</td>
<td>60%-69%</td>
</tr>
<tr>
<td>II.2</td>
<td>50%-59%</td>
</tr>
<tr>
<td>III</td>
<td>40%-49%</td>
</tr>
</tbody>
</table>

Where appropriate, transcripts will show “by compensation”.

6. Students who do not pass the year at the annual examination session will be required to sit supplemental examinations or complete supplemental coursework in those modules failed in the Annual Examination Session.

7. To pass the supplemental examination candidates must achieve a minimum of 40% in each of the subjects examined. Candidates may also pass by compensation if and only if:

- They achieve an overall average mark of 40% or more and either;
  - pass modules totalling 55 credits, and get a minimum mark of 30% in the failed module
  - or
  - pass modules totalling 50 credits, and get a minimum mark of 35% in the failed module(s) (either one 10-credit module or two 5-credit modules).

8. A student’s overall mark will be calculated as the average of each module’s mark weighted by its ECTS rating. A pass at the supplemental examinations is awarded a mark of 40% even if the student achieves a higher mark in the actual examination.

The overall end of year result for a student who is eligible to progress on the basis of marks attained at a supplemental examination will be recorded as “Pass at Supplemental”.

9. The Junior Sophister overall mark contributes 35% to the overall degree mark.
10. The group performing best in Management Science Case Studies will be awarded the Deloitte prize.

11. A student who does not pass by either of the methods above is required to repeat the year in full. This includes completing all assessment elements of all modules (e.g. all continuous assessment requirements).

12. Failure to present at College examinations without good reason will result in a student being excluded from the course.

Students who do not make a serious attempt at their examinations may be excluded from the course.
Part III – Programme Structure

5. An Overview of the Junior Sophister Year

This section lists the Junior Sophister subject modules and a brief description of each is given. Detailed module descriptors are available to view on the student portal, my.tcd.ie. Note: the brief module descriptions may be subject to change. Please refer to my.tcd.ie for the most up to date versions.

**Note:** the following options listed are subject to change for the academic year 2014-15.

<table>
<thead>
<tr>
<th>Mandatory</th>
<th>Software Applications III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td>Statistical Analysis III</td>
</tr>
<tr>
<td>Mandatory</td>
<td>Research Methods</td>
</tr>
<tr>
<td>Mandatory</td>
<td>Information Systems</td>
</tr>
<tr>
<td>Mandatory</td>
<td>Applied Forecasting</td>
</tr>
<tr>
<td>Mandatory</td>
<td>MLA</td>
</tr>
<tr>
<td>Mandatory</td>
<td>Management Science Case Studies</td>
</tr>
<tr>
<td>Mandatory</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>Option</td>
<td>Formal Methods</td>
</tr>
<tr>
<td>Option</td>
<td>Financial and Management Accounting (10 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Human Resource Management (10 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Applied Finance (10 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Investment Analysis (10 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Intermediate Economics (10 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Probability and Theoretical Statistics I (5 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>Engineering Mathematics V (5 ECTS)</td>
</tr>
<tr>
<td>Option</td>
<td>ME4B06 Manufacturing Systems and Project Management (formerly known as 3MEMSS Project and Operations Management) (5 ECTS)</td>
</tr>
</tbody>
</table>
5.1. **ST3001 Software Applications III**

This course will introduce students to Visual Basic programming and students will use Visual Basic to learn how to build small software applications. The course will also give students experience in client server database technologies. This course will be based on various databases such as MySQL and Microsoft Access. The course will introduce students to writing database queries using SQL. HTML and PHP will be used to develop user front ends to these databases.

5.2. **ST3002 Statistical Analysis III**

This module aims to provide an opportunity for students to develop their hands on skills in data analysis. Specific methods will be explored to illustrate these approaches. Module content includes the binomial, poisson, multinomial distributions, model based methods and graphical techniques.

5.3. **ST3004 Research Methods**

Upon completing this module, students should have an understanding of the nature of the research process, drawing upon primary and secondary data sources; be able to locate, analyse and interpret quantitative and qualitative data; and to present the findings.

5.4. **ST3005 Information Systems**

The objective of this module is to introduce students to information systems in business and examines how management information and decision support systems can support improved organisational performance. Information security and control surrounding these systems and aspects of ethical use of IT are also covered.

Specific topics addressed in this module include: Business Processes, Transactions and Information; Introduction to telecommunications and network systems; Emerging Technology; Data Warehousing; Decision Support Systems; Business Intelligence; Digital Markets/Digital Goods; Introduction to Information Systems Security and Information Technology and Ethics.

5.5. **ST3010 Applied Forecasting**

In this module several methods of forecasting will be examined, including exponential smoothing and its Holt-Winters extension, auto-regression, moving average, and further regression based methods that take into account seasonal trends of lagged variables (ARIMA). The module will be practical, and will involve every student in extensive analysis of case study material for a variety of time series data.
5.6. **ST3011 MLA**

This module covers classical multivariate techniques of discriminant analysis, principal component analysis, clustering and logistic regression are examined. There is a strong emphasis on the use and interpretation of these techniques. More modern techniques, some of which address the same issues, are covered in the SS module Data Analytics.

5.7. **ST3008 Management Science Case Studies**

The overall aim of CS2011 is to develop students’ interpersonal, teamworking and analytical skills. This is a problem based learning module. It requires students to apply what they have learned in other modules in MSISS in a simulated real life problem. Specific topics addressed include team working, interviewing, problem solving, conflict resolution, reporting writing and self organising skills.

5.8. **CS3012 Software Engineering**

This module provides students with a solid grounding in various aspects related to building large, important software systems. The overall aim of this course is for students to learn the fundamental skills for building large, important software systems. This entails (i) to recognise the general software lifecycle and its stages from domain analysis to maintenance, (ii) to analyse software in the problem domain, (iii) to identify the fundamental approaches to managing software projects and teams, (iv) to distinguish the roles of stakeholders in a software project in general and in software teams in particular, (v) to recognise architectures for building large-scale distributed software systems.

This course covers various aspects related to building software systems ranging from the use of software lifecycle models, to project management, to large-scale software architectures. Specifically, software lifecycle models, including variations of the waterfall and spiral models as well as extreme programming and agile, are introduced along with concepts that are relevant to the specific model stages. These concepts include UML-based O-O, and domain analysis, requirements and specification analysis, testing and debugging, and version control. Moreover, strategies for managing large software projects and their contracts as well as project teams are presented and contrasted.

5.9. **[Option] CS3016 Introduction to Functional Programming**

Functional programming languages present a powerful, abstract, and important direction in programming languages. The high level of abstraction and the expressive syntax makes program decomposition and composition unusually easy, while the close connections to the underlying semantics make formal reasoning tractable. Systems such as Google’s “Map/Reduce” framework demonstrate the influence of this approach, and the importance to a computer scientist of understanding it.
On this module students will learn to apply the techniques of functional programming in a practical context. The focus is on software design and programming in the functional style, and students will “learn by doing”, through regular weekly programming assignments and case studies.

The module draws on the programming and mathematics background the students have acquired in the first two years of the degree and extends it by teaching new approaches to program design and implementation.

5.10. [Option] BU3530 Financial and Management Accounting

The aim of this module is to develop a deeper understanding of financial accounting and an appreciation for the application of accounting standards, as well as providing information for decision-making and cost-volume profit analysis.

The module is divided into 3 parts:

a. Double Entry Accounting System

In developing a deeper understanding of financial accounting and to fully appreciate the application of accounting standards it is necessary to understand the double entry accounting system. This part of the module will include the essential features of the double entry system from the books of prime entry through to the preparation of financial statements.

b. International Accounting Standards

This section of the module will cover International Accounting Standards both in terms of theoretical knowledge and practical application. This section of the module is a significant development from the knowledge base acquired in the Senior Freshman module, Introduction to Accounting and Financial Management. Prior to embarking on the standards, the Regulatory and Conceptual framework will also be addressed.

c. Introduction to Management Accounting

Management accounting deals with the information needs of internal management as distinct from financial accounting which is in the main directed at the needs of external user groups. This section will address the budgeting process, including the management role it plays within organizations. In addition, the practical issue of the preparation of the budget from initial sales forecast to final budgeted income statement, cash flow and balance sheet will be studied. One of the primary objectives of management accounting is to provide information for decision-making and cost-volume profit analysis will be studied as one such example of how the management accounting function can aid short-term decision-making.
5.11. [Option] BU3570 Human Resource Management

This module aims to:

- describe the professional area of work that is concerned with managing employees and their work in organizations;
- contextualize the practice of HRM in the Irish/EU employment law and industrial relations environment;
- expand upon the practices of HRM (recruitment, training, reward, evaluation) in organizations;
- understand the importance of national, environmental and strategic context for the creation and implementation of HR strategy in organizations.

5.12. [Option] BU3541 Applied Finance

This is a survey module in financial management and covers topics such as bond pricing, types of fixed interest instruments, Equity Markets, Hedging and International Finance.

5.13. [Option] EC3050 Investment Analysis

This module analyses, at both a practical and theoretical level, the process of investment in financial markets. Its aims are to introduce students to the various types of financial instruments in common use and to the economic theories that explain how they are priced. The types of securities considered include interest-bearing securities, equities and derivatives (options, futures, etc.). The focus for the first half of the module will be on fixed income securities and derivatives. As we will see, the principles to be discussed and the analytical tools to be presented have a much wider application in making decisions under conditions of uncertainty. Students are also required to complete a project involving the collection and analysis of financial data. The second half of the module explores how financial markets operate and how securities are bought and sold. The trade-off between higher average returns and more ‘risky’ pay-offs is then discussed. The problem of determining an optimal investment strategy, given beliefs about the probability distribution of returns, is also addressed. Other issues considered include the informational efficiency of financial markets and systematic pricing failures, the role of behavioural biases, and the relative usefulness of fundamental analysis and technical analysis in predicting price movements. This module does not assume previous knowledge of financial economics and for the most part the level of mathematics and statistics does not extend beyond SF Maths and Stats. Students should note, however, that this is an analytical economics module that makes constant use of tools derived from mathematical and statistical concepts. Students interested in working in areas related to investment and finance are likely to find the course of value for their career.

This module provides students with a broad overview of intermediate-level economy theory, covering both microeconomic theory and macroeconomic theory.

The first part of the module addresses microeconomic theory. The material is built around the study of economic agents (e.g. consumers or producers) maximizing objectives (e.g. utility or profits) in an environment of economic constraints (e.g. income or costs). The theory will be supported by a number of applications (e.g. labour leisure choice or consumption-savings choice).

The second part of the module addresses macroeconomic theory. The material is built around the study of the behaviour of the economy as a whole. The approach is based on microeconomic foundations and progresses from individual maximization problems, as studied in the microeconomics module, to macroeconomic issues and issues confronting the aggregate economy.

5.15. [Option] ST2351 Probability and Theoretical Statistics I

This module will describe the fundamentals of probability theory, from the basic axioms of probability to the most commonly used aspects and theorems of the theory. The module covers: Events and Probabilities; The laws of probability; Independence and conditional probability; Discrete random variables; Probability generating functions; Continuous random variables; Multivariate distributions & independence; Moment and characteristic generating functions; The law of averages and The central limit theorem.

5.16. [Option] MA3E1 Engineering Mathematics V

Engineering Mathematics V is a one-semester module available to all JS Engineering streams and continues and extends the material from the previous mathematics modules in the first and second years - 1E1, 1E2, 2E1 and 2E2. The emphasis is primarily on the development of analytical techniques. The module covers Fourier Methods, Partial Differential Equations and Optimisation.

5.17. [Option] ME4B06 Manufacturing Systems and Project Management (formerly known as 3MEMS5 Project and Operations Management)

This module provides a general introduction to operations management of manufacturing systems. It will explore strategies for operating and optimising the production of products in different varieties and volumes with limited resources and in competitive environments. The impacts of design decisions on manufacturing performance and the physical organisation of plants are explored through various DFM and plant layout strategies.

Formal project management methods will be introduced reflecting the growing use of continuous improvement through project management.