

Programme Specification for the MSc Statistics

PLEASE NOTE. This specification provides a **concise** summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. This specification provides a source of information for students and prospective students seeking an understanding of the nature of the programme and may be used by the College for review purposes and sent to external examiners. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the course handbook or on-line at <http://www3.imperial.ac.uk/mathematics/students/postgraduate/msccourseinformation>. The accuracy of the information contained in this document is reviewed by the College and may be checked by the Quality Assurance Agency.

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| 1. Awarding Institution: | Imperial College London |
| 2. Teaching Institution: | Imperial College London |
| 3. External Accreditation by Professional / Statutory Body: | Will seek accreditation from the Royal Statistical Society |
| 4. Name of Final Award (BEng / BSc / MEng etc): | MSc |
| 5. Programme Title (e.g. Biochemistry with Management): | Statistics |
| 6. Name of Department / Division: | Mathematics |
| 7. Name of Faculty: | Natural Sciences |
| 8. UCAS Code (or other coding system if relevant): | N/A |
| 9. Relevant QAA Subject Benchmarking Group(s) and/or other external/internal reference points | Mathematics, Statistics and Operational Research |
| 10. Level(s) of programme within the Framework for Higher Education Qualifications (FHEQ): | Level 7 |
| 11. Mode of Study | The programme is offered as a full-time 1-year course. |
| 12. Language of Study: | English |
| 13. Date of production / revision of this programme specification (month/year): | October 2011 |
| 14. Educational aims/objectives of the programme | The programme aims/objectives are to: <ul style="list-style-type: none"> • Provide high quality education in Statistics within an environment committed to excellence in both teaching and research. |

- Attract well-qualified students and provide intellectual challenge in a structure containing an appropriate amount of flexibility, so that students can develop their individual specialist interests.
- Teach, and provide the opportunities to learn, a core of advanced statistical methods, together with a range of more specialised options in Statistics.
- Expose students to the wide range of applications of Statistics.
- Equip students with a range of statistical skills, including problem-solving, project work and presentation, to enable them to take prominent roles in a wide spectrum of employment and research.

15. Programme Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas.

A Knowledge and Understanding

- A1 The fundamentals of Statistics as a living discipline in its own right.
- A2 The development of the application of Statistics in a wide range of situations relevant to research and real problems arising in science, commerce and industry.
- A3 Problem-solving strategies and methods (including computational skills).
- A4 A selection of subjects which students study in greater depth, according to their interests, leading to current developments at the frontiers of the subject.
- A5 A particular research topic agreed with a supervisor, on which the student writes an original account in his or her own words.

Lectures are an integral part of course delivery in this programme, supported by an office hour system; problems classes and practical computational sessions, where appropriate, are integrated with the lectures.

Students engage in private study in which they work through set problem sheets and individual assignments as well as assimilating lecture content. In the second half of the year students acquire A5 through a major research project. Assessment of knowledge and understanding is through a combination of unseen written examinations, assessed coursework/tests, enhanced coursework assignments, written projects and presentations.

B Skills and other Attributes

- B1 Ability to assimilate and understand a large body of complex concepts and their inter-relationships.
- B2 Knowledge and understanding of the role of statistical reasoning.
- B3 Use of a statistical approach to problem solving, including the importance of assumptions made and consequences of their violation.
- B4 The ability to carry out extended statistical work as an individual.
- B5 Practical skills related to handling data and computational aspects of statistics.

All lecture courses are accompanied by problem sheets or practical coursework, which students work through privately, and supported by group tutorials/problems classes; these are integrated within the timetabled lecture periods. There is access to lecturers informally and through a formal 'office hours' system. Assessment of the lecture material is either by written examinations or by assessed coursework and assignments. Objectives B3 to B5 are acquired through the compulsory individual research project.

C Practical Skills

- C1 The ability to carry out investigative project work as an individual.
- C2 R programming for statistical analysis.

There is a compulsory major research project. Projects are assessed through production of a hard

copy thesis and a compulsory oral presentation.

D Transferable Skills

- D1 Solving open-ended problems and problems with well-defined solutions by formulating problems in precise terms, identifying key issues and trying different approaches in order to make progress.
- D2 Carrying out an independent investigation using textbooks, scholarly articles and other available literature, searching databases and interacting with colleagues and staff to extract important information.
- D3 Communicating effectively by listening carefully and presenting complex information in a clear and concise manner orally, on paper and using IT.
- D4 Using analytical skills, paying attention to detail and using technical language correctly, to manipulate precise and intricate ideas, to construct logical arguments.
- D5 Using IT skills for communication and analysis.
- D6 Working independently, using their initiative, meeting deadlines, planning and executing an extended project.
- D7 Working and interacting constructively with others.

Acquisition of D1 is partly through the methods and strategies outlined in B above.

Acquisition of D2 and D4 comes through coursework, and through the project.

D3 comes through coursework, and through the oral presentation on the project.

Acquisition of D5 is through the compulsory courses “Applied Statistics” and “Computational Statistics”, practical parts of optional courses and the guided preparation of the project dissertation and presentation. Acquisition of D6 is developed progressively through coursework, through the course as students take control of their own learning, through private study, project work and classes and finally the research project.

Acquisition of D7 is mainly through the compulsory project, where the student should interact with the supervisor to obtain an understanding of the research problem.

In this course these skills are developed to a particularly high level. Students need to plan their pattern of work very carefully since their programme of lectures and coursework will depend on their particular option choice.

16. The following reference points were used in creating this programme specification

- * Subject benchmarking information for Mathematics, Statistics and Operational Research (QAA).
- * All course information being subject to approval by Quality and Academic Review Committee of Imperial College London.
- * The Graduate School Postgraduate Quality Committee (PQC).
- * European Higher Education Area (EHEA).

17. Programme structure and features, curriculum units (modules), ECTS assignment and award requirements

The entire MSc course will be worth 90 ECTS. It consists of two elements. The first element consists of the taught courses in the first and second term and is worth 67.5 ECTS. The second element, the project, is assigned 22.5 ECTS.

The programme is organised as follows:

Autumn Term: Four compulsory courses, 30 hours of lectures each

- Probability for Statistics
- Fundamentals of Statistical Inference
- Applied Statistics
- Computational Statistics

Spring Term: Written exam for courses in term one. Courses equivalent to 120 hours of lecturing, e.g. 8 courses of 15 hours each. Assignment of project topic.

Summer Term and Summer: Written exams for courses in Term Two. Work on the project. The project must be handed by the 16th of September.

Optional courses will mostly have 15 hours of lectures. The use of short modules provides the opportunity to cover more of the diverse range of statistical applications. Some suitable MSci courses, which count as 30 hour lecture courses, will be available as options in the MSc. A list of courses on offer can be found in the course booklet which will be placed online. Courses will be examined through assessed coursework and/or a written exam.

Projects can be done within the department or with external collaborators, these might be either scientists in other departments, or collaborators in industry and commerce. Students have to submit a thesis, a substantial written report normally not exceeding 12000 words.

18. Support provided to students to assist learning (including collaborative students, where appropriate).

- Before successful students arrive they receive academic and other advice about their induction into the Department. Furthermore, they receive a reading list of topics in elementary probability and in elementary statistics with which they are expected to familiarise themselves before the start of the programme. Most students admitted to this course will have encountered these topics in their undergraduate programmes.
- On arrival students receive a Welcome Pack including an overall course document together with timetables. This includes a Freshers' Handbook and they are given other general information about safety, libraries, computing facilities, etc.
- The first week of the term will serve as an induction to the department and the programme. Students will meet key members of staff and get acquainted with necessary facilities.
- The Department's staff form our major resource. Most Academic Staff from the Statistics Section are involved in teaching/learning/project support, which have strong research input.
- Each student has a Personal Tutor to assist with personal and academic problems (normally for the duration of the degree course) allocated by the Course Director, and in the Spring Term they should also choose a Project Supervisor who will assist and guide them in the compulsory research project.
- In all lecture courses, classes or practical sessions are held regularly during the timetabled lecture periods.
- All courses are normally included within the 'office-hour' system, where lecturers arrange periods for individual student/lecturer consultations.
- The main College Library has an excellent supply of books and materials and provides a good working environment for private study.
- Many of the academic staff involved in the course have links with industry. In addition there is a programme of research seminars, to which MSc students are invited.
- Students will be encouraged to take student membership of the Royal Statistical Society, and attend the flagship "read paper" meetings, which are preceded by introductory lectures. This provides students the chance to see the highest level of statistical research, and interact with a broader statistical community.

Other facilities include:

- The department is well equipped with computing laboratories, containing new or recent PCs. These machines host the full range of software required for the MSc course. Additionally, the central library provides further computer provision. There are no specialist software licenses required as most of the practical applications will use R, which is freely available.
- The department provides a dedicated room equipped with a number of computers, for MSc students; further, the Mathematics Learning Centre is primarily available for MSc students during the summer when they work on their projects.

- A postgraduate staff-student committee meets regularly during the session. The Statistics MSc student representative and the Course Director are members.
- Open access to the Postgraduate Tutor and the Course Director.
- MathSoc – a society for all members of the Department for academic and non-academic events.
- Careers advice within the Department as well as a College Careers Service.
- Access to student counsellors on the South Kensington site and a Health Centre.
- Access to a Union advisor.
- Access to College Teaching and Learning Support Services.

19. Criteria for admission:

The minimum qualifications for admission are a degree of class 2i or higher, or equivalent, in Statistics, Mathematics or a related subject, such as Engineering or Physics.

20. Processes used to select students:

- Our programme is advertised through the PG Open Day, in college and department web sites as well as in magazines.
- Prospective students apply online. Two references are normally required.
- The Course Director considers the application and supporting evidence, and assesses the applicant's mathematical, statistical and general academic abilities, as well as their motivation and career aspiration, to decide candidate's suitability for the programme and its suitability for their needs. A recommendation of acceptance (conditional or unconditional offer) or rejection is made. If the information in the application is inadequate, a request for further information may be made. Upon receiving the required information, the application will be considered again.
- The PG tutor considers the recommendation and makes the final decision.

21. Methods for evaluating and improving the quality and standards of teaching and learning

a) Methods for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards:

The external examiner system and Boards of Examiners are central to the process by which the College monitors the reliability and validity of its assessment procedures and academic standards. Boards of Examiners comment on the assessment procedures within the College and may suggest improvements for action by relevant departmental teaching Committees.

The Faculty Studies Committees and the Graduate Schools' Postgraduate Quality Committees review and consider the reports of external examiners and accrediting bodies and conduct periodic (normally quinquennial) and internal reviews of teaching provision. Regular reviews ensure that there is opportunity to highlight examples of good practice and ensure that recommendations for improvement can be made.

At programme level, the Head of Department/Division has overall responsibility for academic standards and the quality of the educational experience delivered within the department or division.

Most of the College's undergraduate programmes are accredited by professional engineering and science bodies or by the General Medical Council. Accreditation provides the College with additional assurance that its programmes are of an appropriate standard and relevant to the requirement of industry and the professions. Some postgraduate taught courses are also accredited.

b) Committees with responsibility for monitoring and evaluating quality and standards:

The **Senate** oversees the quality assurance and regulation of degrees offered by the College. It is charged with promoting the academic work of the College, both in teaching and research, and with regulating and supervising the education and discipline of the students of the College. It has

responsibility for approval of changes to the Academic Regulations, major changes to degree programmes and approval of new programmes.

The **Quality Assurance Advisory Committee (QAAC)** is the main forum for discussion of QA policy and the regulation of degree programmes at College level. QAAC develops and advises the Senate on the implementation of codes of practice and procedures relating to quality assurance and audit of quality and arrangements necessary to ensure compliance with national and international standards. QAAC also considers amendments to the Academic Regulations before making recommendations for change to the Senate. It also maintains an overview of the statistics on completion rates, withdrawals, examination irregularities (including cases of plagiarism), student appeals and disciplinarys.

The **Faculty Studies Committees** and **Graduate School Postgraduate Quality Committees** are the major vehicle for the quality assurance of undergraduate / postgraduate courses respectively. Their remit includes: setting the standards and framework, and overseeing the processes of quality assurance, for the areas within their remit; monitoring the provision and quality of e-learning; undertaking reviews of new and existing courses; noting minor changes in existing programme curricula approved by Departments; approving new modules, changes in module titles, major changes in examination structure and programme specifications for existing programmes; and reviewing proposals for new programmes, and the discontinuation of existing programmes, and making recommendations to Senate as appropriate.

The **Faculty Teaching Committees** maintain and develop teaching strategies and promote inter-departmental and inter-faculty teaching activities to enhance the efficiency of teaching within Faculties. They also identify and disseminate examples of good practice in teaching.

Departmental Teaching Committees have responsibility for the approval of minor changes to course curricula and examination structures and approve arrangements for course work. They also consider the details of entrance requirements and determine departmental postgraduate student numbers. The Faculty Studies Committees and the Graduate School Postgraduate Quality Committees receive regular reports from the Departmental Teaching Committees.

Further measures taken within the Mathematics Department include:

- Annual course review through the Board of Examiners of the Course.
- Departmental Postgraduate Staff-Student committee.
- Individual Course Surveys (PGSOLE).
- Annual appraisal of individual staff by Section Heads.
- External Examiner Reports.
- Periodic review of departmental teaching by external review panel – members invited by the Rector and from another university, a research institute and industry. This is organised through the College Science Studies and other Committees.
- Master Degree Programme Course Reviews by the Graduate School Postgraduate Quality Committee.
- Review by the Quality Assurance Agency.

Committees with responsibility for monitoring and evaluating quality and standards

- Departmental Postgraduate Staff – Student Committee.
- Departmental Staff Meeting.
- Departmental Postgraduate Committee.
- Departmental Management Committee.
- Statistics MSc Steering Committee.
- Board of Examiners.

c) Mechanisms for providing prompt feedback to students on their performance in course work and examinations and processes for monitoring that these named processes are effective:

Prompt return of marked coursework, so that students have sufficient feedback.

The results of the written examinations are considered in the Examiners' Meeting for MSci and BSc in June or July, which approves the mark for each course unit (but not the final outcome). Students then get indicative feedback from the Course Director or their Personal Tutors.

The written research project is marked and oral presentations are assessed, and written comments are provided for students.

The monitoring processes include:

- Access to the Course Director when students find feedback inadequate.
- MSc students meetings held in December and February.

d) Mechanisms for gaining student feedback on the quality of teaching and their learning experience and how students are provided with feedback as to actions taken as a result of their comments:

Feedback from students via:

1. Departmental Postgraduate Staff-Student Committee (meets three times a year).
2. Individual Course Survey (PGSole).
3. Research project supervisors meeting their students.
4. Personal tutors meeting their students.
5. Meetings between course director and students, particularly their elected representative.
6. The Postgraduate Tutor being approached by students.

The Statistics MSc Steering Committee will hold an annual course review taking into account the student feedback.

e) Mechanisms for monitoring the effectiveness of the personal tutoring system:

- Access to the Course Director and the Postgraduate Tutor when students find feedback inadequate.
- MSc students meetings held in December and February.
- Departmental Postgraduate Staff-Student Committee

f) Mechanisms for recognising and rewarding excellence in teaching and in pastoral care:

Staff are encouraged to reflect on their teaching, in order to introduce enhancements and develop innovative teaching methods. Each year College awards are presented to academic staff for outstanding contributions to teaching, pastoral care or research supervision. A special award for Teaching Innovation, available each year, is presented to a member of staff who has demonstrated an original and innovative approach to teaching. Nominations for these awards come from across the College and students are invited both to nominate staff and to sit on the deciding panels.

g) Staff development priorities for this programme include:

- Very active research programme in Statistics.
- During probation, lecturers attend a series of College organised workshops on teaching and learning.
- Probationary lecturers are assigned a mentor.
- Staff members have available to them College courses and occasional seminars on teaching and learning.

22. Regulation of Assessment

a) Assessment Rules and Degree Classification:

The Pass Mark for postgraduate taught courses is 50%. In order to be awarded a result of merit, a candidate must obtain an aggregate mark of 60% or greater; a result of distinction requires an aggregate mark of 70% or greater.

Where appropriate, a Board of Examiners may award a result of merit where a candidate has achieved an aggregate mark of 60% or greater across the programme as a whole AND has obtained a mark of 60% or greater in each element with the exception of one element AND has obtained a mark of 50% or greater in this latter element.

Where appropriate, a Board of Examiners may award a result of distinction where a candidate has achieved an aggregate mark of 70% or greater across the programme as a whole AND has obtained a mark of 70% or greater in each element with the exception of one element AND has obtained a mark of 60% or greater in this latter element.

Assessment Rules and Degree Classification specific for this Programme are:

To obtain a **pass mark**, students will have to:

- Register for, and take the examination in courses equivalent to 240 lecture hours, including the 4 compulsory 30 hour lecture courses. They must earn a pass mark (i.e., a score of at least 50%) in courses equivalent to 180 lecture hours with no mark below 40%, and score a weighted average mark of at least 50%. Courses will be weighted by their nominal lecture hours.
A student who earns below 40% in a course examined by a paper will have to re-sit that paper. A student who earns below 40% in a course examined by coursework will be given a re-sit coursework.
- Earn a pass mark (i.e., a score of at least 50%) in the project.

A **merit mark** will be awarded to students who gain a weighted average mark of 60% or above in courses equivalent to 240 lecture hours, including the 4 compulsory 30 hour lecture courses, with no mark below 50%, and who score 60% or above on the project.

A **distinction mark** will be awarded to students who gain a weighted average mark of 70% or above in courses equivalent to 240 lecture hours, including the 4 compulsory 30 hour lecture courses, with no mark below 50%, and who score 70% or above on the project.

b) Marking Schemes for undergraduate and postgraduate taught programmes:

The Pass Mark for all **postgraduate** taught course modules is 50%. Students must pass all elements in order to be awarded a degree.

c) Processes for dealing with mitigating circumstances:

A candidate for a Master's degree who is prevented owing to illness or the death of a near relative or other cause judged sufficient by the Graduate Schools from completing at the normal time the examination or Part of the examination for which he/she has entered may, at the discretion of the Examiners,

(a) Enter the examination in those elements in which he/she was not able to be examined on the next occasion when the examination is held in order to complete the examination,

or

(b) be set a special examination in those elements of the examination missed as soon as possible and/or be permitted to submit any work prescribed (e.g. report) at a date specified by the Board of Examiners concerned. The special examination shall be in the same format as specified in the course regulations for the element(s) missed.

Applications, which must be accompanied by a medical certificate or other statement of the grounds on which the application is made, shall be submitted to the Academic Registrar who will submit them to the Board of Examiners.

d) Processes for determining degree classification for borderline candidates:

Candidates should only be considered for promotion to pass, merit or distinction if their aggregate mark is within 2.5% of the relevant borderline. Nevertheless, candidates whom the Board deems to have exceptional circumstances may be considered for promotion even if their aggregate mark is more than 2.5% from the borderline. In such cases the necessary extra marks should be credited to bring the candidate's aggregate mark into the higher range.

e) Role of external examiners:

The primary duty of external examiners is to ensure that the degrees awarded by the College are consistent with that of the national university system. External examiners are also responsible for approval of draft question papers, assessment of examination scripts, projects and coursework (where appropriate) and in some cases will attend *viva voce* and clinical examinations. Although external examiners do not have power of veto their views carry considerable weight and will be treated accordingly. External examiners are required to attend each meeting of the Board of Examiners where recommendations on the results of individual examinations are considered. External examiners are required to write an annual report to the Rector of Imperial College which may include observations on teaching, course structure and course content as well as the examination process as a whole. The College provides feedback to external examiners in response to recommendations made within their reports.

23. Indicators of Quality and Standards

This is a new course – there are no accreditation reports yet. We intend to apply for accreditation by the Royal Statistical Society.

24. Key sources of information about the programme can be found in

- The Departmental website <http://www3.imperial.ac.uk/mathematics/>

- The website of the Statistics Section of the Mathematics Departmental is at <http://www3.imperial.ac.uk/statistics>

- The course information will be available at <http://www3.imperial.ac.uk/mathematics/students/postgraduate/msccourseinformation>.