

Mathematical Finance MSc

This programme, taught jointly by the School of Mathematics and the Department of Economics, provides the skills that will enable technically able graduates (including in mathematics, science and engineering) to apply their quantitative training to financial analysis.

Study here and find out why the University of Birmingham was awarded The Times and The Sunday Times University of the Year 2013-14
<http://www.birmingham.ac.uk/news/latest/2013/09/20-sep-Birmingham-announced-as-University-of-the-Year.aspx>

Course fact file

Type of Course: Taught

Study Options: Full time, part time

Duration: 1 year full-time, 2 years part-time

Start date: September

Contact

Dr Colin Rowat

Director, MSc Mathematical Finance, Economics

Email: c.rowat@bham.ac.uk (<mailto:c.rowat@bham.ac.uk>)

Dr Colin Rowat (Director, MSc Mathematical Finance, Economics) has a PhD in Economics from the University of Cambridge, and a Certificate in Advanced Risk and Portfolio Management from Baruch College. He is a member of the CFA Institute.

Dr Biman Chakraborty

Deputy Director, MSc Mathematical Finance; Maths

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For programme information please contact the Business School:

Tel: +44 (0)121 415 8273

Email: mscadmissions@lists.bham.ac.uk (<mailto:mscadmissions@lists.bham.ac.uk>)

For admissions enquiries please contact the Admissions Office:

Tel: +44(0)121 414 5488

Email: postgraduate@contacts.bham.ac.uk (<mailto:postgraduate@contacts.bham.ac.uk>)

Links

School of Mathematics (<http://www.birmingham.ac.uk/mathematics>)

Department of Economics (</schools/business/departments/economics/index.aspx>)

Birmingham Business School (</schools/business/index.aspx>)

Details

This programme, taught jointly by the School of Mathematics and the Department of Economics, provides the skills that will enable technically able graduates (including in mathematics, science and engineering) to apply their quantitative training to financial analysis.

In most cases, we expect that graduates from the Masters will take positions in quantitative analysis (or similar) in major financial institutions, such as in the City. The programme also prepares you to pursue further studies in academia.

What they are saying about us



One option is Birmingham... I was external supervisor and reviewer of 10 MSc finance theses in PDE/FDM, MC, MLMC, UVM, ADE option pricing etc. and using C++!! (Nick Webber gave a year course before the theses began). These were the best MSc theses I've seen for a long time, at any university. And that is not just my opinion only. The C++ and math level was excellent. **Posted on QuantNet** (<https://www.quantnet.com/threads/profile-evaluation-for-uk-quant-programs.18540/#post-141774>)



Daniel Duffy
C++ author, trainer

Modules

The programme comprises 180 credits in total (credits are given in brackets).

Term 1 (October – December)

Compulsory Modules

Econometrics with Financial Applications (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06721>) (15+)

forecasting; stochastic volatility; ARCH; GARCH; co-integration; statistical-arbitrage; non-stationarity; unit roots

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Introduction to quantitative finance (<http://selfservice.bham.ac.uk/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=23063>) (10+)

options pricing; Black-Scholes; European and American options; exotic options; fixed income; binomial method; random walks

Computational Methods and Frontiers (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=20445>) (10+)

finite differences; finite elements; numerical solutions; partial differential equations

Risk Analytics (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=22524>) (10)

copulas; Value-at-Risk; expected shortfall (cVaR); mean-variance portfolio optimization; PCA; stress testing; Black-Litterman; live trading

C++ for finance (10+)

valuation system, simulation, polymorphic factory, design patterns, Boost library

Optional Modules

International Banking and Finance (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06727>) (20)

Macroeconomics (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06718>) (20+)

Economic growth, consumption, investment, exchange rates, interest parity conditions, overshooting, speculative attacks, inflation, monetary policy.

Multicriteria Decision Making (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=19613>) (10)

Vector optimization; Pareto efficiency; efficient set; goal programming; partial and total order; invariant order; cone and dual cone.

Nonlinear Programming I (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=19610>) (10)

Optimality condition; convex set and convex function; duality theory; unconstrained optimization; constrained optimization; conjugate gradient algorithms; Newton-type algorithms; interior point algorithms; Lagrangian methods.

Topics in Money and Banking (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=03247>) (10)

Integer Programming (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=21625>) (10)

Alternative formulations; optimality; relaxation; primal and dual bounds; total unimodularity; cut-plane algorithm; branch and bound method; network flow problems; knapsack problems; matching problem; assignment problem; set covering problem

Relevant modules for those without all the requisite undergraduate mathematics training include: PDEs, Transform Theory, and Complex Variable Theory for Physicists.

Graduate modules offered elsewhere in the University may also be taken with the Programme Director's approval.

Term 2 (January - March)

Compulsory Modules

Econometrics with Financial Applications (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06721>) (+15)

forecasting; stochastic volatility; ARCH; GARCH; co-integration; statistical-arbitrage; non-stationarity; unit roots

Exotic options, bonds and further quantitative finance (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=23064>) (+10)

options pricing; Black-Scholes; European and American options; exotic options; fixed income; binomial method; random walks

Computational Methods and Frontiers (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=20445>) (+10)

finite differences; finite elements; numerical solutions; partial differential equations

C++ for finance (+10)

valuation system, simulation, polymorphic factory, design patterns, Boost library

Optional Modules

Economics of Financial Markets (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06730>) (20)

consumption-based CAPM; equity premium; factor models; time-varying risk; behavioural finance

Macroeconomics (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=08&pgCrse=06718>) (+10)

Economic growth, consumption, investment, exchange rates, interest parity conditions, overshooting, speculative attacks, inflation, monetary policy.

Non-Linear Programming II (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=20441>) (10)

Optimality condition; convex set and convex function; duality theory; unconstrained optimization; constrained optimization; conjugate gradient algorithms; Newton-type algorithms; interior point algorithms; Lagrangian methods.

Combinatorial Optimisation (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=20442>) (10)

Alternative formulations; optimality; relaxation; primal and dual bounds; total unimodularity; cut-plane algorithm; branch and bound method; network flow problems; knapsack problems; matching problem; assignment problem; set covering problem

Advanced quantitative finance: crashes, volatility, multiple assets and hedging (<http://selfservice.bham.ac.uk/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=23065>) (10)

crashes; volatility modeling; multi-asset options; hedging; liquidity; asset allocation; stochastic control; historical lessons; Monte Carlo

Conic optimization (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=23557>) (10)

Interior point algorithms; semi-definite programming; conic optimization; quadratic optimization; Semi-definite relaxation; finance and engineering applications.

Heuristic Optimisation (<http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=19611>) (10)

Exhaustive search; tapu-search, local search; greedy algorithms; dynamic programming; computer simulation; evolutionary Algorithms.

[Research Frontiers in Management Mathematics \(http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=19614\)](http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=06&pgCrse=19614) (10)

Semi-infinite programming; economic equilibrium problems; projection algorithms; fixed-point methods; merit functions.

[Security Analysis and Portfolio Theory \(http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=07&pgCrse=02932\)](http://cis67.bham.ac.uk:7782/webhandbooks/WebHandbooks-control-servlet?Action=getModuleDetailsList&pgSubj=07&pgCrse=02932) (20)

Mean-variance portfolio optimisation, market efficiency, behavioural finance, duration, convexity, CAPM, hedging.

Relevant modules for those without all the requisite undergraduate mathematics training include: Numerical Methods in Linear Algebra, Programming. Graduate modules offered elsewhere in the University may also be taken with the Programme Director's approval.

Term 3 (May - June)

Examination Period

July - September

Dissertation (40)

Students are encouraged to pursue internships while writing their dissertations

Fees and funding

£16,070 (UK/EU and overseas). Please check with the Department for the latest fees information.

Part Time: home/EU/overseas - £8,035

Learn more about [fees and funding \(/postgraduate/pgt-fees/fees.aspx\)](/postgraduate/pgt-fees/fees.aspx)

Fees for the MSc are the same for all students to ensure that we only have incentives to admit the most qualified students, regardless of nationality. See the University's [student accommodation \(http://www.has.bham.ac.uk/studentaccom/\)](http://www.has.bham.ac.uk/studentaccom/) page for information on housing. See the [International Office \(http://www.international.bham.ac.uk/prospective/finance\)](http://www.international.bham.ac.uk/prospective/finance) page for information on the overall costs of a degree in Birmingham.

Scholarships and studentships

A variety of scholarships are available to help students on the MSc in Mathematical Finance fund their studies. All applicants are automatically considered for Fisher Scholarships, awarded to attract the most able students to the MSc, regardless of nationality. The Fisher Scholarships, available from 2008, have been made possible by a generous private gift from [Andrew Fisher \(http://www.towry.com/about/executive-biogs\)](http://www.towry.com/about/executive-biogs) (Birmingham economics, 1982; CEO, Towry).

More information on funding opportunities is provided by the [Student Funding Office \(http://www.birmingham.ac.uk/students/fees/postgraduate\)](http://www.birmingham.ac.uk/students/fees/postgraduate). For scholarships with automatic eligibility, students will be informed of decisions over the summer, once final exam results are known.

Entry requirements

A good Honours first degree (or overseas equivalent) in Mathematics or a related numerate subject such as Physics or Engineering, or an appropriate Joint Honours degree in industrial mathematics.

Good students whose undergraduate degree did not prepare them sufficiently for the MSc mathematics, may wish to consider the School of Mathematics [Pre-Masters Certificate in Mathematics \(http://www.birmingham.ac.uk/students/courses/postgraduate/taught/maths/pre-masters-certificate-in-mathematics.aspx\)](http://www.birmingham.ac.uk/students/courses/postgraduate/taught/maths/pre-masters-certificate-in-mathematics.aspx). Students attaining an average of at least 60% qualify for the MSc in the following year; those attaining 64% or higher qualify for a 20% fee discount on the MSc.

Learn more about [entry requirements \(http://www.birmingham.ac.uk/students/pg/requirements\)](http://www.birmingham.ac.uk/students/pg/requirements).

International students

We accept a range of qualifications from different countries – learn more about [international entry requirements \(http://www.birmingham.ac.uk/students/pg/requirements/international\)](http://www.birmingham.ac.uk/students/pg/requirements/international)

[Standard English language requirements \(/postgraduate/requirements-pgt/international/index.aspx\)](/postgraduate/requirements-pgt/international/index.aspx) apply

English language requirements

Non-native speakers of English can find our [English language requirements listed under Business \(http://www.birmingham.ac.uk/students/requirements/requirements-pg/international/index.aspx\)](http://www.birmingham.ac.uk/students/requirements/requirements-pg/international/index.aspx) (open the IELTS/TOEFL/PTE section). Applicants who have studied in English at the university level do not need to provide further evidence of proficiency. The University of Birmingham offers [pre-sessional English courses \(http://www.eisu.bham.ac.uk/courses/preessionieap\)](http://www.eisu.bham.ac.uk/courses/preessionieap) for students wishing to improve their English before beginning their academic studies.

How to apply

When clicking on the Apply Now button you will be directed to an application specifically designed for the programme you wish to apply for where you will create an account with the University application system and submit your application and supporting documents online. Further information regarding how to apply online can be found on the [How to apply pages \(http://www.birmingham.ac.uk/students/courses/postgraduate/apply-pg/index.aspx\)](http://www.birmingham.ac.uk/students/courses/postgraduate/apply-pg/index.aspx)

[Apply now \(https://pga.bham.ac.uk/lpages/COS098.htm\)](https://pga.bham.ac.uk/lpages/COS098.htm)

Learning and teaching

Special events

The programme gives students access to special events that enhances their experience, such as a week long master class in C++ for finance with [Daniel J. Duffy \(http://www.datasimfinancial.com/\)](http://www.datasimfinancial.com/).





Thank you very much for the C++ training. I have worked with my student in China using C++ and API to build up a securities trading platform. This programme is over 20,000 lines. C++ is very useful. I still keep in contact with Daniel Duffy. **Zhenya Liu (Board of Directors of J.P. Morgan Futures Co., Ltd)**

Guest Speakers

Students have been addressed by seminar speakers from: ABN AMRO, BetOnMarkets, Deutsche Bank, Evolutionary Technology, Morgan Stanley, the Numerical Algorithms Group, the Royal Bank of Canada, Royal Bank of Scotland, Royal London Asset Management and StreamBase.

Resources

In July 2011, we enrolled in **StreamBase University** (<https://owa.bham.ac.uk/owa/redirect.aspx?C=059c80717894496db7f9b556f7e8a216&URL=http%3a%2f%2fwww.streambase.com%2fcommunity%2fstreambase-university%2f%23axzz1pIGw1V00>), giving our students access to Streambase's complex events processing software.

Students enrolled on the MSc Mathematical Finance programmes also have access to a password-protected **discussion list** (<http://www.listarc.bham.ac.uk/lists/msc-mat-fin>) and **wiki** (https://www.mediawiki.bham.ac.uk/msc-mf/index.php/Main_Page).

Related staff

Dr Colin Rowat (</staff/profiles/business/rowat-colin.aspx>)

Employability

Graduates from this MSc programme will be well prepared to compete for quantitatively demanding positions in financial institutions. The degree should also prepare them for postgraduate research, either for purely academic ends or to further qualify them for work in financial institution.

Destinations of recent graduates include Bank of America/Merrill Lynch, BNP Paribas, China Jianyin Investment Securities, Deutsche Bank, the FSA, LGIM, Société Générale and wonga.com.

The MSc laid the foundation for my investment banking career, giving me a strong understanding of the relevant economic theory and mathematics. Together, this allows me to understand the various products/trades used in the market today.

Aravind; Quant Developer, BNP Paribas, London. He has a first class undergraduate degree in Computer Science from Anna University, helped code Ninja Trader and has worked as a Java developer.



The quantitative finance that I learned are essential to my work at Changsheng Fund Management, helping me pick the right trading strategies, and conduct pre-trade analysis and post-trade consultations.

Kun Du has an undergraduate degree in Maths from Birmingham, and was a member of the Investment Society as a student. Changsheng is one of China's first and largest fund management houses.



The MSc helped me get a summer internship with BetOnMarkets in the middle of the credit crunch. I used my training to improve our volatility modeling, saving us hundreds of thousands of dollars; I've now been sent back to the UK to open up our London offices this autumn. Our teachers have been very supportive, both during the MSc and afterwards.

Jeremy is a structure for Legal & General Investment Management. His quant skills are underlaid with an undergraduate degree from the Université des Sciences Sociales in Toulouse and an MSc in Economics from the University of Leicester.



This MSc helped me supervise various kinds of quantitative analytical projects and give fast, yet efficient and reliable recommendations to my team. I clearly see a great difference in my overall quantitative finance knowledge and feel much more confident than the previous year.

Sanjeevani works as an Associate VP in Quant Research for Amba Research. She has a first class degree in Chemical and Process Engineering from University of Moratuwa and develops quantitative and statistical models for European and US Hedge funds.



When Ernst & Young hired me, I used my math finance degree to be allocated to projects related to quantitative finance: I'm almost the only staff member with both mathematical and economic knowledge.

Hung has an undergraduate degree is from the Singapore Institute of Management; he placed top globally on a number of his University of London external exams.



Mathematical Finance gave me a headstart in understanding the underlying theories of the financial sector's workings. I am able to apply many of the techniques learned in my day-to-day work at the Financial Services Authority (FSA).

Rachel has an undergraduate degree in Maths and Music, during which she also worked as a music teacher. She earned a distinction studying her MSc.





The MSc equipped me to work as a market risk analyst in a commodity broking firm. The coursework and projects were structured to meet the demands of the financial services industry; those running it are approachable and helpful, taking great efforts to constantly tune it to the industry's changing needs - making the MSc more than an academic experience.



Arun is a risk analyst at Marex Spectron. He has a first class undergraduate degree from the College of Engineering at Guindy. He worked in programming and trade support for three years prior to the MSc, and the Bank of America afterwards.

