MSc Cyber-Security
2018–19

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Who am I?

- Former Head of Information Assurance for Fujitsu Telecommunications
- Security lead on BT/Fujitsu relationship for ADSL and voice
- ~~Had a mid-life crisis~~ Did PhD in formal verification of trusted execution full-time 2010–14
- Had in fact been industrial reviewer of the predecessor course in Computer Security, one of the first such MSc courses in the UK

What is this course?

- GCHQ-accredited (but see caveats) course in Cyber Security
- Intended to equip you for roles in private and public sector, doing both technical security and managing security accreditations and risk assessments
- GCHQ and NCSC want more people in more roles to be able to be “risk owners”, improving the cyber-security of the UK and (to be a little pretentious) the world.
- Focus is on designing and building correct systems, but courses range more widely over the security landscape
- Core elements, plus choice of modules from other programmes (again, see caveats)

Source of Truth

- Maintaining the multiple locations where programme structures are described is a nightmare
- Every organisation faces this problem, and only enterprises which are small, new or run by geniuses (and probably all three) can honestly say that their information is entirely consistent
- As you will learn in SSM, maintaining accurate data is a major security objective
- **This presentation is correct**, as of 21 Sep 2018. It is taken directly from module approval documents. Other sources of information may not be quite up-to-date.

The course

- An MSc is 180 credits.
  - For comparison, and as a warning of the hard work ahead, an undergraduate degree is 120 credits per year.
- This consists of **60 credits of compulsory modules**, **60 credits of optional modules** drawn from a wide choice, and **60 credits of project**.

Structure

- Semester 1: introduction to cyber security, plus 20cr available to fit in either preparatory networking course if you do not have that knowledge, or other courses depending on your interests.
- Semester 2: a smaller number of compulsory modules, plus a range of security and security-related modules for you to choose from
- Semester 3: Exams
- The summer “holiday”: Project

Compulsory Modules	**Autumn**	**Spring**	**Summer**
Cryptography	10		
Designing Secure Systems	10		
Secure Programming	10		
Secure System Management	10		
Forensics and Malware Analysis		10	
Network Security (Extended)		10	
Project (CompSci - MSc)			60
Total	**40**	**20**	**60**

Sixty Optional Credits From	**Autumn**	**Spring**
Compilers & Languages (Extended)	10	
Networks (Extended)	20	
Operating Systems (Extended)	20	
Advanced Cryptography		10
Computer-Aided Verification (Extended)		10
Hardware and Embedded Systems Security		10
Intelligent Data Analysis (Extended)		10
Mobile & Ubiquitous Computing (Extended)		20
Penetration Testing		10
Security Research Seminar		10
Individual Study 2 *(can only be taken once)*	*10*	*10*
Recommended Total	**20**	**40**

Compulsory for GCHQ Accreditation

Compulsory Courses

- Semester 1 (40cr)
  - Secure System Management (10cr)
  - Secure Programming (10cr)
  - Designing Secure Systems (10cr)
  - Cryptography (10cr)
- Semester 2 (20cr)
  - Network Security (10cr)
  - Forensics and Malware Analysis (10cr)

Optional Modules Sem1

- Compilers and Languages (Extended) (10cr)
- Networks (Extended) (20cr)
  - Recommended if you do not have a strong networking background
- Operating Systems (Extended) (20cr)
  - Obvious option if you are happy with networks
- Individual Study 1 (10cr)

Optional Modules Sem2

- Advanced Cryptography (10cr)
- Penetration Testing (10cr)
- Hardware and Embedded System Security (10cr)
- ~~Enterprise Systems (Extended) (20cr)~~
- Individual Study 2 (10cr)
- Security Research Seminar (10cr)
- Intelligent Data Analysis (Extended) (10cr)
- Mobile and Ubiquitous Computing (Extended) (20cr)
- Computer-Aided Verification (10cr)

Now comes the caveat

- Advanced Cryptography (10cr)
- **Penetration Testing (10cr)**
- **Hardware and Embedded System Security (10cr)**
- ~~Enterprise Systems (Extended) (20cr)~~
- Individual Study 2 (10cr)
- Security Research Seminar (10cr)
- Intelligent Data Analysis (Extended) (10cr)
- Mobile and Ubiquitous Computing (Extended) (20cr)
- Computer-Aided Verification (10cr)

Compulsory for “GCHQ Pathway” if you want the accreditation

Individual Study

- Allows you to pursue a topic which is not on the curriculum, but for which you can convince a lecturer to supervise your **self-study**.
- Please only do this if you are passionate about a topic. If you simply cannot find something you want to do (I hope this is not true!) please speak to me as early as possible: it should be possible for you to do some other module in the school's catalogue. Doing Individual Study to just fill the credits is a lot of work for often indifferent rewards
- In particular, if you want to do the compilers course, please speak to me about finding a different "off the books" 10 credit module, or consider 70/50 or 50/70 split. Don't just do Individual Study for the sake of 10 credits.

Programme Changes from 2016 and 2017

- The withdrawn Incident Management and Forensics module has been incorporated into Forensics and Malware Analysis, and into Secure System Management.
- Some of the withdrawn Anonymity, Privacy and Cybercrime has been incorporated into Designing Secure Systems.
- GCHQ are aware of these changes and it does not affect the certification.
- Product of (mostly) student feedback and (to a much lesser extent) staffing changes. The programme has been improved by these changes, leaving more room for other content.
- Not all public material has caught up.

Projects

- Bit early to decide, but worth thinking about
- **Must be security related**
- Do not necessarily have to be programming: can be studies, research, a range of possibilities
- I need to approve them, and if you are doing something unusual, talk to me as early as possible
- Be very careful of projects tied into sponsors or employers: they can be very difficult to make work in terms of the academic requirements. I will usually refuse them.
- **You must do your project in Birmingham; you cannot do it remotely**

Dates

- Taught modules in Semester 1, “Autumn Term”
  - 1 Oct 2018 to 14 Dec 2018 (late finish this year)
- Taught modules in Semester 2, “Spring Term”
  - 14 Jan 2019 to 29 Mar 2019
- Unlike some universities, **all exams are in Semester 3,** “Summer Term”
  - 29 Apr 2019 to 21 Jun 2019 (again, a late finish)
  - Main exam period is provisionally 7 May to 7 June
- Project done after exams, with submission date probably 3 September 2019 (this is an informed estimate)

Communication

- **READ YOUR STUDENT EMAIL EVERY DAY**
- Everything else is done via Canvas. ~~Except for the stuff that isn't.~~

Lecture Support

- All lectures should be recorded via Panopto and made available through the Canvas pages for the module.
- If there are modules where this is not happening, please let me know. It is university policy that all lectures are recorded, but there may be good reasons why in particular cases it is not done.
- As a minimum, the slides should also be available. Some courses will have written notes as well, but it is not universal.

Assignments

- Assignments will be announced and submitted via Canvas.
- If you feel that there are pile-ups of deadlines, please let me know, however…
  - …you are big boys and girls, and because we give you a lot of options from other programmes we cannot always guarantee that you won’t get clashing deadlines.

Assessment

- Most modules are what we call “80:20”: 80% of the marks are from a final exam in Semester 3, 20% of the marks come from continuous assessment.
- There may be exceptions ranging from 100% exam to 100% continuous: your lecturer will tell you at the start of the course, and you should ask if you are not clear

Pass Marks

- The pass-mark for M-Level modules is 50%. Any module less than 50% precludes getting a merit or a distinction.
- If you fail a module with a mark of between 40% and 50%, it may still be possible to get an MSc (we call this a “soft fail”)
- All taught modules can be retaken **at most once**. There are some modules which do not have a retake opportunity other than by repeat (Security Research Seminar, notably). Most retakes are exam-only (ie, coursework is not re-used). Retakes are capped at 50%, so are unlikely to help your overall average much no matter how well you do.
- If you fail **any** module twice with a mark of less than 40%, **you cannot get your MSc (a “hard fail”)**
- The Exams Officer (Dr Eike Ritter) can provide the precise details if you need them. The next slide is a summary which is correct for most cases that will apply to you.
- There are different rules which we can talk about if it arises covering whether you can progress to your project with fails.
- **Best advice: pass the modules! Don’t explore the outer edges of the regs.**

Pass Marks

	All modules	Taught modules	60 credit project
MSc	WM ≥ 50%	All ≥ 40% 80 cr ≥ 50%*	≥ 50%
MSc with Merit	WM ≥ 60%	All ≥ 50% WM ≥ 55%	≥ 55%
MSc with Distinction	WM ≥ 70%	All ≥ 50% WM ≥ 65%	≥ 65%

WM is mean of all marks, weighted by credits

* 80 credits with each module individually ≥ 50%

The bare minimum

- The minimum to get an MSc at Birmingham is 80 taught credits ≥ 50%, 40 taught credits ≥ 40%, a project ≥ 50%, the whole lot averaging ≥ 50% when weighted by credits
- For example 80 taught credits all borderline passes at 50%, 40 taught credits borderline not-hard-fails at 40% and a project at 56% has a weighted average of 49.77% which would be rounded to 50% and pass.
- **Please, please please don't test this idea.** I might have miscalculated.

Feedback

- School policy is ten working days
- University policy is fifteen working days
- Please let me know if the ten-day deadline is missed ~~even if it's me~~.
- The school's intention this year is that new exercises should not be set unless the feedback has been completed from the previous exercise, but there may be exceptions to this: this is a fast-moving programme.

Tooling

- We are a Unix/Linux shop (and use Macs because they are good Unix machines)
- You will be given various virtual machines to work with, so it is as well to confirm that you can run either VirtualBox (preferably) or one of the VMware products.
- If you use a Mac, or a Linux laptop, then you can do some of the work directly.

Programming Languages

- We'd love it if you were all fluent in C
- If you aren't, it is possible to complete the course using Java, although you should not attempt the Operating System course unless you can program in C (this year there will not be a programming assignment in Networks)
- If you have neither C nor Java, then it would be an idea to start looking at them now!

People

- Course Director: Dr Ian Batten
- Director of Post Graduate Study: Dr Paul Levy
- Head of Security Group: Prof. Mark Ryan