The University of York

Professional Development and Training in:
- System Safety Engineering
- Cyber Security

Developing your future in the workplace
Introduction

As technology advances into every part of our lives, safety and security of both control and information systems is ever important. Whether that be the safety of systems in industries such as aerospace, nuclear, automotive or medicine, or the threat of viruses and hackers to a company’s data, the need for safety and security is all around us.

Here at York, we recognise the need to keep the skills of engineers and professionals up to date to keep on top of any such threats and challenges. We offer a suite of professional development short courses in a range of topics in the disciplines of system safety engineering and cyber security.

**System Safety Engineering**
System safety engineering is concerned with the systematic analysis and assessment of "systems of systems", platforms and systems to identify and evaluate safety risks, and influence design and operation to reduce risks.

Classical hazard and safety analysis techniques have dealt poorly with computers and software, particularly as modern systems are highly integrated, and often networked to form “systems of systems”. Addressing these issues is the sub-discipline of safety critical systems engineering for computer based systems.

Our courses provide a comprehensive grounding in the principles of system safety engineering and safety critical system engineering, to refresh, renew and extend your skills in this area.

**Cyber Security**
Security of systems and data is one of the most challenging topics of our time. There is an international consensus that the level of security skills will have to be increased in order to respond to the number and sophistication of threats we face. The UK government declared cyber security a tier 1 priority in 2010, on the same level as international terrorism.

Reviewing the 2011 Government Cyber Security Strategy, worth £650m, in
February 2013, the National Audit Office identified a large skills gap in this area. Our short courses cover the core topics you need to know about in order to make effective cyber security decisions.

Learn from the experts
You will learn from experts in their fields: our staff have considerable industry and research experience. This experience, coupled with up to date training materials and real-life industrial case studies, helps you to learn in the context you need. We constantly refresh our courses to stay on top of the latest trends and developments, so what we teach is at the very forefront of your chosen topic.

Our courses are well respected by industry, and we have provided training for delegates from many different domains, including:

- Military: BAE Systems, Qinetiq, Sytell
- Civil Aerospace: Airbus, GE Aviation Systems, Thales, Rolls Royce
- Automotive: Jaguar Land Rover
- Nuclear: Office for Nuclear Regulation
- Railway: Chinese rail industry, Alcatel
- Marine: Royal Hydrographic Office
- Medical: Connecting for Health
- Health & Safety Executive
- British Energy

Work towards a recognised award
You can choose to study the short courses as individual units, or use them to count towards a recognised postgraduate award. We offer an MSc in both Cyber Security and Safety Critical Systems Engineering.

Our courses in system safety engineering are accredited by both the Institute of Engineering and Technology (IET) and the BCS (the Chartered Institute for IT), and can count towards the educational component for chartering. They also fully accredit our MSc in Safety Critical Systems Engineering. We are currently seeking accreditation for our Cyber Security courses.

We look forward to welcoming you on one of our courses soon.
Why choose to study at York?

- Learn from internationally respected experts in the field.
- Learn core principles that are transferable across industry domains.
- Refresh your knowledge to enhance job performance.
- Study is broken into manageable one week blocks.
- Choose to study for a recognised postgraduate award.
- Keep up to date with the latest trends.

Our expertise

You will be taught by world-leading experts in the field, who have worked extensively in industry as well as undertaken research into the discipline. Our staff sit on safety standards committees for both the civil aerospace and military domains and have had a significant impact on the content of such standards.

Our research has helped to shape some of what is done in system safety today. One example is the Goal Structuring Notation (GSN) developed at York to improve industrial practice in developing and presenting safety case arguments, which has become an embedded and established international approach to safety case development. GSN now appears in a number of national and international safety standards as a recommended approach to safety case development.

With this overview of both relevant research and industry experience, we are able to develop our teaching in response to new advances and the requirements of industry, to keep your skills and knowledge up to date.
“The case studies were very good, showing how various safety methods and analysis are used in real life.”
“As a practitioner of system/functional safety in the automotive industry I cannot recommend the MSc in Safety Critical Systems Engineering highly enough. The course structure and the mandatory modules cover the fundamentals of system safety in such depth and breadth as to be applicable to any safety standard. Unlike previous degree courses I refer to my York notes a great deal, since they are extremely relevant to my day to day safety activities.”

Robert Palin, Jaguar Land Rover

Courses at a glance

System Safety Engineering
- Computers and Safety
- Foundations of System Safety Engineering
- Hazard and Risk Assessment
- Human Factors for Safety Critical Systems
- Safety Case Development and Review
- Safety Management Systems
- Software Requirements and Architectures
- Software Testing Analysis and Review
- System Safety Assessment
- Systems Engineering for Safety
- Through Life Safety

More information at www.cs.york.ac.uk/professional/safety

Cyber Security
- Cryptography Theory and Applications
- Cyber Security Research Skills
- Identity, Trust, Reputation and their Applications
- Malware and other Malfeasance
- Networks and Communications Security: Threats, Attacks and Countermeasures
- Principled Approaches to Security: From Threats to Effective Countermeasures
- Rigorous Specification and Modelling of Dependable Systems
- Software Measurement and Testing

More information at www.cs.york.ac.uk/professional/cyber

All courses are taught in one week blocks at the University of York. Further details on each one and when they are taking place can be found at www.cs.york.ac.uk/professional
“One of the best courses I have been on. I gained a good appreciation of system safety and the analysis techniques involved.”

“As a clinician working for the Department of Health Informatics Directorate, supporting software architects, engineers and project managers to deliver safe technology to the NHS, I have found the MSc in Safety Critical Systems Engineering to be absolutely essential. The quality of the lectures, teaching materials and content delivered is second to none.

I have not undertaken any training or education since qualifying as a clinician that has been so relevant, useful and practical for my daily job. I would recommend that anyone working in healthcare with an interest in patient safety should take the Foundations of System Safety Engineering module at the very least.”

Beverley Scott, Clinical Safety Advisor, Department of Health Informatics Directorate
System Safety Engineering

All our courses in system safety engineering meet the IET Position Statement on Safety Critical Systems. Visit www.cs.york.ac.uk/professional/ietprinciples for more details.

The short courses are a great way of experiencing our teaching and starting in the discipline. If you pass the optional assessment, you can then use the results if you choose to register for an MSc, Postgraduate Diploma or Certificate.

If you are thinking about studying for an award, we recommend that you take Foundations of System Safety Engineering first.

Foundations of System Safety Engineering
An introduction to the principles of system safety, including:
- risk;
- basic concepts;
- the main types of hazard and safety assessment techniques;
- a brief overview of legal issues, management of safety critical projects, and human factors.

Hazard and Risk Assessment
You cover topics including:
- hazard identification;
- application of hazard analysis techniques;
- risk assessment;
- management and tracking of safety-related risks throughout the life of a system.
Systems Engineering for Safety
You will cover:
- an introduction to the technical and organisational aspects of systems engineering for system safety engineers;
- early lifecycle systems analysis (including links to Operations Research) and modelling (i.e. systems concepts, requirements and architectures);
- systems engineering principles applicable to a range of critical engineering systems (e.g. control systems, platforms, systems of systems and autonomous and configurable systems);
- key organisational challenges related to technology readiness and process maturity.

“One of the most enjoyable, practical and effective external courses I’ve attended.”
“The course taught me a lot, including the right mind-set and a sound, systematic and methodical approach.”

Software Requirements and Architectures
You will learn:
- a strong set of principles and techniques for structuring and representing requirements and architectures.

System Safety Assessment
This course includes:
- classical system safety analysis techniques, with an emphasis on fault trees (FTA), Failure Modes and Effects Analysis (FMEA) and Markov Analysis;
- System Safety Assessment techniques incorporating Model-Based Safety Assessment (MBSA) methodologies;
- the impact of massively increased amounts of safety data on safety assessment;
- assessment of information systems, such as navigation systems.

Human Factors for Safety Critical Systems
This course introduces concepts and techniques that can be used to support
the design and evaluation of complex interactive systems, with a particular emphasis on safety critical systems:  
- work analysis (including task analysis and scenario analysis);  
- human error assessment;  
- design and evaluation of interactive systems;  
- human reliability assessment;  
- ergonomic, psychological and socio-technical factors that are relevant to an understanding of safety critical systems.

Safety Case Development and Review  
This course addresses:  
- production and assessment of safety cases within safety projects;  
- role, purpose and typical content of a safety case;  
- how safety case arguments can be selected and critically assessed;  
- development and maintenance of safety cases into the engineering lifecycle;  
- regulatory context for a safety case development regime;  
- related concepts of safety, assurance and compliance cases.

Software Testing Analysis and Review  
This is an introduction to systematic methods of verification, covering:  
- a range of static and dynamic techniques and their use within the development process from the point of view of safety critical systems;  
- testing, including various automated and manual static analysis techniques;  
- how increased rigour at the specification stage can significantly help lower-level testing.

Safety Management Systems  
You will gain an awareness of the issues associated with conducting technical safety activities within an organisational and regulatory environment, including:  
- applying theoretical safety engineering knowledge in situations constrained by available staff competence, resources and organisational culture;  
- the relationship between business and safety risk management;
“Exercises and case studies really help to cement the lecture material.”
Through Life Safety
This course addresses the safety issues that arise after system deployment:

- comparing equipment and operational safety cases;
- operational procedures for safety implications;
- processes for the maintenance of ALARP in operation;
- data collection using information from the design safety case;
- analysis of operational data for safety;
- issues relating to multiple organisations interacting in a safety programme;
- the application of techniques for accident modelling;
- the role of emergency planning in through life safety.

Computers and Safety
This course is primarily intended to give system safety engineers an introduction to the issues that must be considered when computers are used in safety critical or safety-related applications. It covers:

- an overview of how computer systems work, from hardware up to application software;
- areas of potential concern to system safety engineers;
- the software development process, in particular aspects of requirements specification, design and analysis that are critical to deployment of computers in safety critical application;
- structuring and collecting of evidence for a software safety case.
Cyber Security

Identity, Trust, Reputation and their Applications
This course addresses issues such as:
- how to reliably identify agents and their communications;
- approaches for deciding whether and how to engage with agents.

Cryptography Theory and Applications
You will cover topics such as:
- design, analysis and implementation of cryptographic primitives and services;
- key management frameworks.

Malware and other Malfeasance
You will look at:
- how malware, such as viruses and worms, actually work;
- how to detect malware;
- principles and practices of intrusion detection.

Networks and Communications Security: Threats, Attacks and Countermeasures
This course gives a broad understanding and knowledge of network security, addressing threats over a range of sophistication levels. You will cover:
- primary technical components of network security;
- threats, requirements and control solutions;
- network-specific attacks and attack mechanisms;
- security strengths/weaknesses in network mechanisms.
“Thoroughly enjoyed the course - I found it to be both useful and interesting.”
Principled Approaches to Security: From Threats to Effective Countermeasures
You will address the following issues:
- technical issues of information security governance;
- legal aspects (and how they differ between countries) and cultural issues;
- how to put together a convincing argument for security (a security case);
- risk based trade-offs that must be made when systems are developed and deployed.

Rigorous Specification and Modelling of Dependable Systems
You gain an understanding and hands-on experience of rigorous approaches to secure and dependable system development. You will also address:
- use of traditional formal methods (formal specification, program proof and so on);
- stochastic model checking;
- software reliability mathematics;
- system safety reliability analysis.

Software Measurement and Testing
This will help you to use and understand software metrics as well as the importance of testing. You will cover:
- identifying software verification as an integral part of the development process and not as one of its (final) phases;
- strengths and weaknesses of well-established testing techniques;
- the importance of human factors in setting up/changing a software testing process within a software development team.

Cyber Security Research Skills
You are introduced to aspects of being a successful researcher in cyber security. Through a mock cyber security conference, you will:
- give appropriate critical feedback;
- communicate cyber security issues to a variety of audiences;
- write cyber security research proposals.
Converting to a postgraduate award

MSc/Diploma in Safety Critical Systems Engineering
Postgraduate Certificate in System Safety Engineering
MSc in Cyber Security

We offer flexible postgraduate programmes suitable for part-time students, so you can convert your short course study into a recognised academic award.

The MSc awards are made up of a certain number of compulsory modules in each case – please visit www.cs.york.ac.uk/postgraduate/taught-courses for more details.

“Enjoyed the mix of theory with industrial anecdotes, enhanced by academic lecturers with good practical experience.”
Bespoke courses

In addition to those described, we can provide a range of courses tailored to your specific requirements, either on-site or at the University of York. You can choose any of those listed in this leaflet, or, if you have a specific area of interest in system safety, we are happy to discuss your requirements.

We have delivered bespoke courses for major defence and transport sector companies (automotive, rail, aerospace), military and public bodies, academic departments and independent safety assessment organisations, including BAE Systems, Airbus, Syntell, Rolls-Royce and Invensys, in locations all over the world, including Australia, Europe and the UK.
Book your place

To book on any of the courses or to find out about registering for a postgraduate degree, please contact:

Professional Development and Training Administrator
Email: postgraduate@cs.york.ac.uk
Telephone: +44 (0)1904 325402

You can also find more information and book online at www.cs.york.ac.uk/professional

“Excellent course, extremely knowledgeable and articulate lecturers, and the course material will be an invaluable reference.”
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We offer a range of short courses in the disciplines of system safety engineering and cyber security. These courses help you to refresh, renew and extend your knowledge in these areas, keeping you up to date with the latest advances in this dynamic sector.

For full details of all the courses available and information about the Department, please visit our website at www.cs.york.ac.uk/professional