UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Reliability and Safety Engineering
Module Code	ENB6009-B
Academic Year	2021/2
Credits	20
School	Department of Mechanical and Energy Systems Engineering
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Lectures	20
Tutorials	20
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims

The students will be able to develop a detailed knowledge of the theories, principles and practices of reliability and safety engineering and apply these principles in the design, operation and maintenance of complex systems.

Outline Syllabus
Reliability Engineering: Fundamental concepts of reliability engineering. Basic definitions. Bathtub hazard rate curve. Constant failure and repair rate models. Reliability block diagrams. Steady state and transient availability. Reliability data banks (electrical, electronic, mechanical, communication and oil). Use of life distributions (Weibull, Normal, Lognormal) and discrete distributions (Poisson, Binomial) in risk and reliability. Estimation of reliability parameters using graphical methods. Fault Tree Analysis (FTA): construction, qualitative and quantitative analyses. Common cause analysis. Notions of Markov modelling and Monte Carlo Simulation. Relevant BS and Mil. Standards. Product liability and sustainability including reliability, maintainability, serviceability, re-cyclability, re-manufacturability, disposability and reusability. Safety Engineering: Concepts of Safety Engineering and Management. COMAH (Control of Major Accident Hazards) and SEVESO Directives. System Safety Process. Process Safety and Environmental Protection (PSEP). Loss Prevention. Hazard reduction precedence. Safety Standards. Safety in Manufacturing, Chemical Process and Nuclear Power industries. Safety Management: Safety in the system life cycle. Organisational Management and Safety. System Safety Programme. Hazard Analysis. Process Safety Analysis: Preliminary Hazard Analysis (PHA). Hazard and operability studies (HAZOP). Failure modes effects and criticality analysis (FMECA). Hazard Analysis Critical Point Technique (HACCPT). Bow-Tie Analysis and Layers of Protection Analysis. Event Tree Analysis. Safety Instrumented Systems. PFDs and PIDs and safety Engineering. Safety devices (PSV, ESD, EDPV). Safety devices (PSV, ESD, EDPV)

Learning Outcomes	
Outcome Number	Description
01	1.1 Critically appraise the use and review of complex reliability and safety engineering tools and their practical application in complex systems.
02	2.1 Apply reliability and safety tools and techniques to real-world examples in a wide spectrum of industries. 2.2 Estimate reliability parameters of simple and complex systems. 2.3 Calculate the reliability of complex systems taking into account. 2.4 Perform complex Reliability Block Diagrams calculations, use discrete and continuous statistical distributions in Reliability Analysis, and perform HAZOP and Fault Tree Analysis. 2.5 Carry out a quantitative Safety Engineering study. 2.6 Apply System Safety Standards to complex applications. 2.7 Include Human Factors in complex engineering safety applications.
03	3.1 Enhance your skills in data management; data presentation; scientific method; data interpretation; IT skills; systematic problem solving; and creative problem solving.

Learning, Teaching and Assessment Strategy
Concepts, theories and principles explored in formal lectures, and practiced in tutorials, all of which will be delivered online. Practical, cognitive and personal skills developed in problem solving exercises, tackled by working in small groups supported by members of academic staff. Video presentation, where appropriate, will be used to enhance learning and bring to life practical issues related to safety and loss prevention. Oral feedback is given during tutorials. Face to face meetings with individual groups will be set up to provide further support and guidance, as appropriate. Guest speakers (online presentations) will enhance learning and provide practical reliability and safety engineering experience. The examination will consist of an online 24 hours examination and group coursework. The latter will include peer review based on the use of TeamMates. Both components of assessment will examine the wider learning outcomes expressed in the descriptor. Supplementary assessment is to repair deficiency in the original assessment.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Examination - Open Book	Examination Open Book (2 Hrs)	50%
Summative	Coursework	Group Coursework (2000 words per Student)	50%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.
