

About The Course

The course duration is 3 days and will consist of both theoretical and practical applications of risk and reliability engineering. The course will introduce the fundamentals of Risk analysis and reliability engineering. Reliability, availability and maintainability (RAM) Analysis will be dealt with. Quantity riskanalysis, basic statistics, distribution of failure, reliability of failure, consequences of failure and monte-carlo simulations (MCS).

On successful completion of this course, you will be able to: 1) identify and analyse the concepts and principals of risk and reliability engineering and their potential applications to different engineering problems. 2) Assess and analyse appropriate approaches to the collection and interpretation of data in the application of risk and reliability engineering methods. 3) Evaluate and select appropriate techniques and tools for qualitative and quantitative risk analysis and reliability assessment. 4) Analyse and evaluate failure distributions, failure likelihood and potential consequences and develop solutions for control/mitigation of risks.

Why should we do a risk and reliability analysis?

- Enable good decision making in the presence of uncertainty.
- Demonstrate that all risks are identified and appropriately mitigated or reduced (ALARP)
- Moral- risk of death or serious injury (Safety)

- Legal- comply with regulators.
(UK-Health and Safety Executive)
- Economic- profit, return for investors/
Shareholders.

Who Should Attend?

This training is suitable for mechanical, process, energy engineers and professionals that want to obtain knowledge on applied aspects of risk and reliability engineering.

Cost £995 + VAT (for UK only)

Payment

Payments can be made by cheque (made payable to ASRANet Ltd.), cash or bank transfer. Please enquire for details.

Contact

ASRANet
Ltd.
47
Westbourne
Crescent
Bearsden
Glasgow
G61 4HB

W www.ASRANet.co.uk/courses

E info@asranet.co.uk

T +44 (0)7764575990

Payment enquiries: +44 (0)7712731566

ONLINE COURSE (VIA ZOOM) Risk Analysis & Reliability Engineering

6-8 December 2021



(A Maritime Company for Courses, Conferences and
Research)

PROGRAMME

Monday 6th December 2021

07.00 – 08.30 Lecture 1: Basic Statistics
Prof Purnendu Das

08.30 – 08.45 *Break*

08.45 – 10.15 Lecture 2: Basic Probability
Prof Purnendu Das

10.15 – 10.30 *Break*

10.30 – 12.00 Lecture 3: Accelerated life testing & Analysis of Life Data
Dr. T. V Santhosh

12.00 – 12.30 *Break*

12.30 – 14.00 Lecture 4: RCM Analysis
Dr. T. V Santhosh

Tuesday 7th December 2021

07.00 – 08.30 Lecture 5: Introduction to Risk Analysis
Prof Edoardo Patelli

08.30 – 08.45 *Break*

08.45 – 10.15 Lecture 6: Introduction to Monte Carlo simulation method
Prof Edoardo Patelli

10.15 – 10.30 *Break*

10.30 – 12.00 Lecture 7: Quantitative Risk Assessment: FMEA, FMECA, and HAZOP
Prof Edoardo Patelli and Dr T.V Santhosh

12.00 – 12.30 *Break*

12.30 – 14.00 Lecture 8: Event Tree and Fault Tree Human reliability techniques
Dr T.V Santhosh

Wednesday 8th December 2021

07.00 – 08.30 Lecture 9: Efficient Monte Carlo Simulation methods
Prof Edoardo Patelli

08.30 – 08.45 *Break*

08.45 – 10.15 Lecture 10: Reliability analysis and Uncertainty quantification with COSSAN Software
Prof Edoardo Patelli

10.15 – 10.30 *Break*

10.30 – 12.00 Lecture 11: Reliability & Maintainability and Reliability testing
Dr T.V Santhosh

12.00 – 12.30 *Break*

12.30 – 14.00 Lecture 12: System Reliability Techniques
Prof Edoardo Patelli and Dr T.V Santhosh

Lecture Content

Lecture 1

Introduction to statistics and basic statistical terms (e.g. correlation, covariance, etc.)

Lecture 2

Introduction to Probability with a focus on understanding and being able to apply basic concepts (e.g. mean, variance, etc.)

Lecture 3

Objectives of life tests

Types of tests

Qualitative and quantitative accelerated life testing

Acceleration factor

Selection of life distributions

Life-stress models

Case study

Lecture 4

Concepts of maintenance

Principles of RCM

Categories of RCM

RCM program

Case study

Lecture 5

Introduction to Risk Analysis

Basic concept of Safety and Risk Analysis.

Definition of Reliability and Availability and Resilience

Qualitative and Quantitative Risk Assessment

Lecture 6

Basics of simulation, Monte Carlo simulation

Advantages and limitation of Monte Carlo methods

Lecture 7

Quantitative Risk Assessment: FMEA, FMECA and HAZOP.

Introduction to the Failure mode, effects, and criticality analysis (FMECA)

Hazard and operability study analysis (HAZOP)

Lecture 8

Definitions, Fault tree and Event tree modelling, Basic component data models, Risk quantification, Importance measures, Common cause failures, Human reliability modelling

Industrial case study

Lecture 9

Advanced Monte Carlo methods for reliability analysis Important sampling, Line Sampling and Subset Simulation.

Lecture 10

Demonstrations by reliability software COSSAN Software Models and their capabilities

Lecture 11

(RAM) Introduction to maintenance strategies and reliability-based maintenance.

MTTF calculations, Time & Failure terminated reliability testing, Confidence level.

Lecture 12

Reliability block diagram, Reliability bounds method, Redundancy techniques, Electronic reliability, Software reliability, Survival signature and load-flow approach, Resilience modelling.

ABOUT THE LECTURERS:

Professor Purnendu Das

BE, ME, PhD, C.Eng, C.MarEng, FRINA, FIStructE, FIMarEST has been the Director of 'ASRANet from its inception in February 2006. He retired as Professor of Marine Structures in the Department of Naval Architecture & Marine Engineering at the University of Strathclyde, UK. Past EU projects were MARSTRUCT (a network of excellence on Marine Structure) and SHIPDISMANTL (a cost effective and environmentally friendly dismantling of ship structures). Past industrial projects included work from the UK Health and Safety Executive (HSE), MoD UK, Subsea-7 UK, Shell, Wood group and US Navies etc. He was the principal investigator of many EPSRC projects. Before joining the University of Glasgow in 1991 he worked with British Maritime Technology as Principal Structural Engineer (1984- 91). He is the author of more than 250 publications, including contract reports and more than 60 journal papers and was a member of the editorial boards of the 'Journal of Marine Structures', 'Journal of Ship & Offshore Structures', 'Journal of Engineering under Uncertainty: Hazards, Assessment and Mitigation' and 'Journal of Ocean and Climate System' amongst others. His areas of research include limit state design and analysis & reliability analysis of ship & offshore structures. Professor Das has wide ranging industrial and academic contacts and has advised and supervised 20 PhD students, to his credit. Details of visits and collaborations include his various sabbatical study periods spent at University of California, Berkeley, USA (July – September 1996), at Lloyd's Register of Shipping (August 1997), Kockums Ltd (July 1998) and spent some time at Instituto Superior Técnico (IST), Lisbon (July 2000). He has been running various successful CPD courses which are attracting many people from different industries. These courses are on 'Fatigue & Fracture Analysis', 'Ships at Sea', 'Advanced Analysis and Design of Offshore Structures', 'Offshore Floating System Design', 'Structural Response under Fire and Blast Loading' and 'Design of Pipelines and Risers' amongst others. He was a member of ISSC (International Ship and Offshore Structure Congress) for the periods of 1991-97 and 2003 – 2006. He was a member of the OMAE (Offshore Mechanics and Arctic Engineering) Organizing Committee on 'Safety and Reliability'. He has organized six ASRANet International Conferences in 2002 (Glasgow), 2004 (Barcelona), 2006 (Glasgow), 2008 (Athens), 2010 (Edinburgh) and 2012 (London) where a large number of participants from various countries attended. The theme of the conference is the integration of risk, advanced structural analysis and structural reliability analysis as applicable to various engineering structures. He was the member of Research committee of the Institution of Structural Engineers (I.Struct.E) London for 3 years (2014- 2017). At present he is a visiting professor at the University of Montenegro, Montenegro and University of Stavanger, Norway.

Prof Edoardo Patelli

Edoardo Patelli is a Professor in Risk and Uncertainty and head of the Centre for Intelligent Infrastructure, at the Department of Civil and Environmental Engineering, University of Strathclyde. Before moving to the University of Strathclyde in 2019, Prof Patelli was the deputy director of the Institute for Risk and Uncertainty and co-director of the Centre for Doctoral Training in "Risk and Uncertainty" at University of Liverpool. He is also the Chair of the Technical Committee on Simulation for Safety and Reliability Analysis for the European Safety and Reliability Association (ESRA). Patelli is the principal investigator of the EPSRC projects in Resilience modelling for improved nuclear safety (EP/R020558/1) and Machine learning on-line monitoring tools (EP/M018415/1). He is also CoI on the NERC project Building UK climate resilience through bridging the qualitative-quantitative data divide (NE/S016961/1), the ESRC project "Informed mining: risk reduction through enhanced public and institutional risk awareness (IM AWARE)" - (ES/T003537/1) and "Efficient reliability analysis of complex systems", German Research Foundation (Project number 335796111). Patelli has published more than 250 peer-reviewed publications in leading International journals and in Proceedings of International Conferences and 4 book chapters. He has supervised more than 25 PhD students on site and in collaboration with international partners (e.g. Dalian University and NTHU, Hannover and Grenoble). He is a guest-editor on International journals (e.g. International Journal of Reliability and Safety and Structural Safety) and editorships Springer's "Encyclopedia of Earthquake Engineering". He organized multi-disciplinary international conferences in risk and vulnerability (ASCEICVRAM-ISUMA 2014), and probabilistic analyses (e.g. IPW2015, REC2018). He is also the Chair of the Technical Committee of the 2019 European Safety and Reliability Conference (ESREL) and member of the board editor of the ASCE-ASME journal of Risk and Uncertainty. Dr. Patelli is leading an interdisciplinary research group focused on developing and apply efficient and robust computational tools for Risk, Safety and Uncertainty Quantification across different sectors (Nuclear, Energy, Aerospace, Civil, Environmental) able to deal with scarce data and vagueness of information. Recent research interests include human reliability analysis and interaction with intelligent and autonomous systems. development of robust artificial neural networks and on-line diagnostic tools based on machine learning for the analysis and reliability of safety critical systems. Particular emphasis is on the development of resilience framework of power networks and smart grids as well the development of tools for decision making under severe uncertainty.

Dr. T. V. Santhosh

Dr. Santhosh is a senior scientific officer at Bhabha Atomic Research Centre (BARC), Mumbai, India, and he was in the UK during last 2 years as a postdoctoral research associate at Institute for Risk and Uncertainty, University of Liverpool, UK. He joined BARC in 2001 after obtaining Post Graduate Diploma in Nuclear Science and Engineering. He received his Bachelor's degree in Electrical and Electronics from Bangalore University, Masters in Reliability Engineering from IIT Bombay, and PhD in Engineering from Homi Bhabha National Institute, Mumbai. He is a faculty of BARC Training School and delivered several short-term courses on risk and reliability. Dr. Santhosh has been Guide and Technology Advisor for several bachelor and master theses on risk, reliability, operator support system, virtual simulation, artificial intelligence and accelerated life testing. He is a permanent member in several committees of Atomic Energy Regulatory Board for nuclear power plant safety. He has published over 80 publications in refereed journals and conferences. He was a key contributor for several nuclear and non-nuclear projects for obtaining clearance from the ministry of environment. He was Co-collaborator for a few national and international projects including one EPSRC project. He is also a recipient of DAE Group Achievement Award in 2015 for his outstanding research contributions. He is currently working on EPSRC project on "A Resilience Modelling Framework for Improved Nuclear Safety".