Subject Description Form

Subject Code	EE5381
Subject Title	System Assurance and Safety in Railways
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: EE538
Collaboration Institute	MTR Academy
Objectives	1. To allow students to appreciate the importance of safety in railway operation and the required organisation for hazard management. 2. To provide students with a comprehensive understanding on the relationship between railway safety and service performance objectives and application of methodologies of system assurance and safety risk. 3. To enable students to acquire knowledge on the key management processes and analysis techniques adopted in various project phases. 4. To enable students to apply international standards on railway system assurance and safety risk. 5. To enable students to acquire hand-on experience from railway operators on system assurance and safety risk practices.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify safety performance indicators and the safety risk principles to produce such indicators. b. Given a railway sub-system, devise the simple safety risk ranking and matrices; and carry out hazard operability study. c. Conduct various system assurance analyses with different techniques to ensure fulfillment of international standards for different purposes. d. Organise safety committees, formulate system assurance programme planning and develop safety cases. e. Analyse the collected safety statistics and plan the hazard registration system. f. Appreciate the safety management skills required in engineering systems g. Recognise the importance to engage in self-learning on latest technologies on railway systems at this advanced level of study.
Subject Synopsis/ Indicative Syllabus	1. *Safety Risk Assessment*: Railway safety performance, lifecycle safety management process, ALARP (As Low AS Reasonably Practicable) principle, societal perception of risk, risk ranking and matrices, closed-loop risk management process, tolerability of risk and formulation of risk criteria, value of preventing a fatality, equivalent fatality, risk mitigation principle 2. *System Assurance Analysis Techniques & Standards*: Hazard & operability study, use of guidewords in identification of hazards, fault tree analysis, event tree analysis, cause-consequence analysis, preliminary hazard analysis, operation & support hazard analysis, cost-benefit analysis, qualitative and quantitative risk analyses, system safety modelling, classification of safety critical items, human error & system safety, safety integrity level & software, MIL STD 882D, IEC 61508, EN50126, BS 5760

	3. *Organisation & Programme Management*: Safety committees, system assurance programme planning, structure of system safety report/safety Case, in-service safety risk monitoring programme, collection and use of safety statistics, hazard registration system, hazard management organisation.
	Case Study:
	MTRCL System assurance practices
	Industrial/Research seminars

Teaching/Learning Methodology	Lectures and tutorials are effective teaching methods:

Lectures and tutorials are effective teaching methods:

1. To provide an overview or outline of the subject contents.
2. To introduce new concepts and knowledge to the students.
3. To explain difficult ideas and concepts of the subject.
4. To allow students to feedback on aspects related to their learning.

Mini-project works/Assignments are essential ingredients of this subject:

1. To supplement the lecturing materials.
2. To add real experience for the students.
3. To provide deeper understanding of the subject.
4. To enable students to organise principles and challenge ideas.

Case studies:

1. To give real examples for some of the concept presented in the lectures.
2. To explain some practical considerations when applying technologies in real projects
3. To motivate and stimulate students interest

Teaching/Learning Methodology	Outcomes						
	a	b	c	d	e	f	g
Lectures	✓	✓	✓	✓	✓		
Tutorials			✓	✓	✓		
Mini-project works/Assignments					✓	✓	✓
Case studies						✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed						
		a	b	c	d	e	f	g
1. Examination	60%	✓	✓	✓	✓	✓		
2. Class Test	20%	✓	✓	✓	✓	✓		
3. Assignments/Mini-project works	20%			✓		✓	✓	✓
Total	100%							

The understanding on theoretical principle and practical considerations, analytical skills and problem-solving technique will be evaluated. Examination, class tests, assignments,

presentations and mini-project report are an integrated approach to validly assess students' performance with respect to the intended subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	39 Hrs.
	Other student study effort:	
	▪ Assignment/Mini Project	21 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	**Textbooks:** 1. D.J. Smith, Reliability, Maintainability and Risk, 5th Edition, Butterworth-Heinemann, 1997 2. J.D. Andrews and T.R. Moss, Reliability and Risk Assessment, Longman, 1993 3. F. Redmill, M. Chudleigh and J. Catmur, System Safety: HAZOP and Software HAZOP, Wiley, 1999 **Reference books/journals:** 1. EN50126:1999 "Railway Applications – The specification and Demonstration of Reliability, Availability, Maintainability and Safety" 2. MIL -STD-882D "Standard Practice for System Safety", Department of Defence, USA	

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