STELLENBOSCH UNIVERSTY
FAKULTY OFENGINEERING
STUDY GUIDE

1. MODULE DATA

MODULE CODE	MODULE	CALENDER YEAR	SAQA CREDITS	WORK LOAD h/week
442	SERTIFISERING	2007	8	6

PROGRAMME YEAR	SEMESTER	LECTURING LOAD	HOME DEPARTMENT
4	2	1.5*ℓ*, 0.5*p*, 0*t*, 1*s*	Electrical and Electronic Engineering

LECTURER(S)	OFFICE NUMBER(S)	CONTACT DETAILS
Prof HC Reader (EMC and Legislation) Dr K Marais (Risk and Applied Ethics)	E408 M406	hcreader@sun.ac.za kmarais@sun.ac.za

CLASSIFICATION OF KNOWLEDGE AREAS	Mathematics	Basic science	Engineering science	Design & Synthesis	Computing & IT	Complemen-tary Studies
			3			5

ECSA EXIT LEVEL OUTCOMES (marked with x only if the module has ECSA exit level outcomes)	Problem solving	Application of scientific and engineering knowledge	Engineering design and synthesis	Investigations, experiments and data analysis	Engineering methods, skills, tools and IT	Professional & technical communication	Impact of engineering activity	Individual, team and multidisciplinary work	Independent learning ability	Engineering Professionalism
							X			X

PREREQUISITE MODULES	PREREQUISITE PASS (P≥50)	PREREQUISITE (K≥40)	COREQUISITE
	None	None	None

ASSESSMENT DETAILS	METHOD (Examination/Continuous/Project)	CLASS MARK CALCULATION	FINAL MARK FORMA
See Year Book Parts 1 and 11 for regulations.	Continuous	See below	P = 0,5xEMC + 0,5xRisk A student has to **also** meet the specified outcomes of the module in the relevant assessments/questions in order for a final mark of 50 or above to be awarded. A numerically calculated mark of 50 or above does not necessarily mean a pass.

EMC and Legislation class mark determination:

Prac 1:	30%
Prac 2:	20%
Seminars	20%
Standards and Legislation	30%

Risk and Applied Ethics class mark determination:

Class participation:	10%
Individual Assignments:	10%
Group Reports:	50%
Group Presentations:	30%

Note: if any differences exist between the Afrikaans and English versions of this document, the English document will be regarded as correct.

Approved by:

Programme Coordinator

Chairperson

2. SPECIFIC OUTCOMES AND ASSESSMENT CRITERIA

ECSA Exit Level Outcomes assessed in this module	
Outcome	**How is Exit Level Outcome assessed?**
7. Impact of Engineering activity*:* Demonstrate *critical awareness* of the impact of engineering activity on the social, industrial and physical environment.	Risk analysis and EM interference understanding is evaluated through individual assignments, seminars, group reports and group presentations
10. Engineering Professionalism*:* Demonstrate *critical awareness* of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.	Main core of this course. Will be evaluated through individual assignments, seminars, group reports and group presentations

CAPABILITIES These are the aims of the module		
A student who completed this module can: • Understand technical and electromagnetic aspects of electromagnetic compatibility (EMC) • Articulate and debate the issues of responsibility around EMC • Consider the nature of EMC certification and measurement processes • Decide what risk there may be in in-house EMC assessment • Define risk, safety, and reliability • Perform FMEA, fault tree, and event analyses of engineering systems • Understand and discuss the limitations of FMEA, fault tree, and event analyses wrt to software and human and organizational factors • Analyse and critically evaluate risk-benefit and cost-benefit analyses		
PERFORMANCES This is the type of question a student can expect in the exams and tests. More than one of these performances can be expected in a single exam or test question.	**ASSESSMENT CRITERIA** The examiners will give credit if the student successfully performs the following tasks.	**RANGE STATEMENTS** These statements further describe the nature and complexity of the required performance.
Assess the critical aspects of EM interference (EMI) and propose remediation measures	• Maxwells equations are correctly applied • Measurements are appropriately applied	The student must be able to: • Measure, analyze and compute the E and B field coupling • Understand current diversion techniques • Analyze EM boundary conditions
Describe the legislation and CE mark certification process	• Major EMC legislation is correctly described • CISPR measurements are appropriately specified	The student must be able to: • Read EMC standards • Understand the legislation process • Assess the viability of in-house certification
Link the legislation to the electromagnetic understanding of system design and coupling	• Demonstrations of design, mitigation and risk principles are correctly interpreted	The student must be able to: • Integrate EM and practical understanding of problems
Define and contrast the concepts of risk,	• The terms were correctly defined.	The student must be able to:

safety, and reliability, illustrating your definitions with examples	• The terms were correctly contrasted. • Examples were given that illustrated the definitions and contrasts.	• Explain the concepts of risk, safety, and reliability • Identify real-world examples that illustrate and contrast the concepts of risk, safety, and reliability
Perform a failure modes and effects analysis (FMEA) on a simple given system.	• The failure modes were correctly identified • The effects were correctly identified and assessed	The student must be able to: • Identify failures, their modes, and effects on a given system
Perform a fault tree analysis on a simple given system	• The system was correctly broken down into component failures • The component failures were correctly combined to identify system failure probabilities	The student must be able to: • Break a system down into its component failures • Synthesize a fault-tree of the system using the component failures • Analyse the fault tree using fault tree techniques
Perform an event tree analysis on a simple given system.	• Chains of events leading to system level failures were correctly identified and recorded.	The student must be able to: • Break a system failure down into a sequence of events • Synthesize an event-tree of the system using the event sequence • Analyse the event tree using event tree techniques
Discuss the limitations of FMEA, fault tree, and event analyses wrt to software and human and organizational factors	• The limitations of FMEA, fault tree, and event analyses were correctly identified and discussed.	The student must be able to: • Understand the limitations of FMEA, fault tree, and event analyses wrt to modern socio-technical systems
Perform a critical assessment of given risk-benefit and cost-benefit analysis.	• The student was able to assess a risk- or cost-benefit analysis and identify the limitations and weak points of the analysis.	The student must be able to: • Critically assess cost-benefit analyses of real-world systems

THIRD QUARTER PLANNING

Week	Theme	Lecture, Seminar or Practical	Notes
1-3	Technical and legislative aspects of EMC	There will be: 2 practicals on E and B-field coupling, a lecture series on legislation and seminars on standards	Always meet at lecture venue first. Seminars will require student preparation and presentations
4-6	In-house assessment and responsibility	There will be: demonstrations of mitigation methods, in-house and independent EMC assessment and discussions on responsibility	

FOURTH QUARTER PLANNING

Week	Theme	Lecture (1 hr)	Seminar (2 hrs)	Homework	Pre-Readings
1	Introduction to Risk	Definition of risk Aspects of risk Cultural attitudes to risk	**Class debate** on responsibility for risk Cases: Ford Pinto (movie: Class Action), Tylenol (movie: The Insider) Risk communication	Readings only.	TBD Accident descriptions to each group.
2	Decision Analysis and Accidents	Heuristics and biases Utility theory	**Lecture**: Accident Causes, Accident Models, Safety vs. Reliability **In-class work**: Group accident analyses (~20 groups)	Decision-analysis exercises, individual. Preparation for in-class presentation..	TBD
3	Accidents and Risk Assessment Techniques	**Group presentations** of accident analyses, part I	**Lecture**: FMEA, Fault trees, Event trees **Group presentations** of accident analyses, part II.	Hand in your slides and buddy rating after the presentations. Hand in individual decision analysis exercises.	TBD
4	Risk Assessment Techniques	Limitations of traditional techniques **Case discussions**: ISS analysis, other*** Gas Leak Introduction	**In-class work**: FMEA, Fault and event tree analyses of gas leak, Sapphire SW	Complete in-class analyses of gas leak technical factors. Hand in draft group reports on analyses.	TBD

5	Software, Human and Organizational Factors in Risk, Part 1	Expand on limitations of event-based risk approaches Software contribution to risk Theory on human, organizational, societal contribution to risk	**Case discussions**: Ariane 5, Mars Lander, Challenger/Columbia **In-class work**: Continue gas leak example, now consider software, human, and organizational factors.	Continue in-class analyses of gas leak.	TBD
6	Risk-benefit Analysis	Cost-benefit analyses Valuation of life Limitations Other approaches	**Class discussion** on several real-world cost-benefit analyses. Lessons learnt Course Evaluation	Hand in group reports and buddy ratings on analyses.	TBD