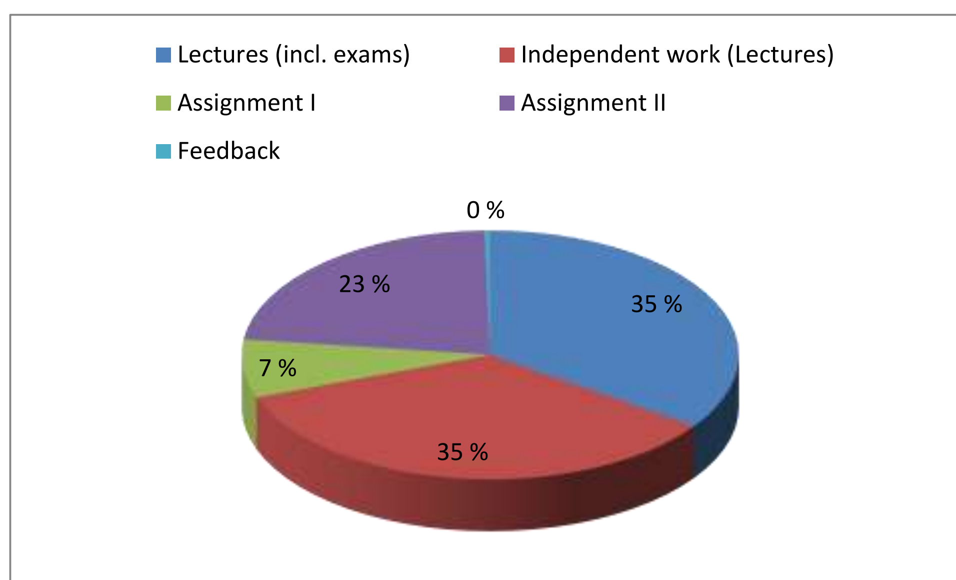
ELEC-E8712 DESIGN FOR RELIABILITY (5 CR)

STUDY PLAN
48+(12) (4+1) I-II

Lectures Tuesdays and Thursdays 8.30-10.00 Micronova “Iso-Sali” 2190
Learning environment and Information: MyCourses
Registration: Oodi (Only for the course, no registration to mid-term exams)
Teacher: D. Sc. Vesa Vuorinen
Contents: General principles electronics reliability. The design for reliability and lifetime prediction of electronic devices. The most common failure modes and mechanisms of components and devices under different operational environments. Principles of reliability testing and failure analysis
Requirements: Midterm exams (3) + 2 Assignments
Literature, targeted as background material for self-studying: Laurila, T., Vuorinen, V., Paulasto-Kröckel, M., Turunen, M., Mattila, T.T., Kivilahti, J., Interfacial Compatibility in Microelectronics - Moving Away from the Trial and Error Approach; J. Liu, Reliability of Microtechnology, V. Puligandla, Failure Modes and Mechanisms in Electronic Packages; D. Crow, A. Feinberg, Design for reliability; D. H. Stamatis, Failure mode and effect analysis: FMEA from theory to execution.
Language: in English

Workload	
	Hours
Lectures (incl. exams)	46
Independent work (Lectures)	46
Assignment I	10
Assignment II	30
Feedback	0,5
Total	132,5
Credits	4,96



Grading

Task	Points
1st Midterm exam	15
2nd Midterm exam	15
3rd Midterm exam	20
Assignment 1	Excellent(2p)/Pass(0p)/Fail
Assignment 2	Excellent(8p)/Good(5p)/Pass(2p)/Fail
Total	60

Points	Grade
30 - 34	1*
35 - 39	2
40 - 45	3
46- 51	4
≥52	5

- In order the get accepted grade, both assignments must be accepted

SCHEDULE:

Date	Subject
13.9, 15.9, 20.9 and 22.9	**No lectures** Assignment I instructions
27.9	1. General presentation of the course The reliability of electronics- big picture and "pre-exam
29.9	2. Design for reliability I, The need for reliability
4.10	3. Design for reliability II, Stress vs. Strength, Concurrent Engineering
6.10	4. Design for reliability III, FMEA Assignment II instructions, **A1 DL**
11.10	5. Environmental stresses I
13.10	6. Environmental stresses II,
18.10	***No lecture***
20.10	**1st Midterm Exam**
25.10	7. Accelerated testing – HALT,
27.10	8. Accelerated testing – ALT, Screening (HASS, ESS, Burn-In)
1.11	9. Accelerated environmental testing: 85/85, THB, HAST
3.11	10. Corrosion in electronics, Classification of environmental conditions.
8.11	11. Corrosion properties of metals in electronics, Corrosion tests
10.11	**2nd Midterm Exam**
15.11	12. Failure mechanisms in passive and active components, Electromigration
17.11	13. Packaging, trends, process, die attach.
22.11	14. Direct chip attachment methods- Wire Bonding
24.11	15. Direct chip attachment methods- TAB, FC, **A2 DL**
29.11	16. PWB reliability, Electronic connectors
1.12	17. Solder joint reliability I, General aspects, THT and SMT Thermal Aspects of Soldering, SMT joint quality
6.12	**No lecture**
8.12	18. Solder joint reliability II, Solder materials,
13.11	19. Solder joint reliability III, Reliability of solder materials under thermomechanical, mechanical loading, Course recap and conclusions
15.12	**3rd Midterm Exam**
20.12	**Extra Midterm exams**