Examination Feedback for EEE6008 - Reliability and Failure
Autumn Semester 2009-10

Feedback for EEE6008 Session: 2009-2010

Feedback: Please write simple statements about how well students addressed the exam paper in general and each individual question in particular including common problems/mistakes and areas of concern in the boxes provided below. Increase row height if necessary.

General Comments:

Performance in Q1 and Q2 are reasonable but on average students struggled in Q3 and Q4.

Question 1:

In part (a) most of you can identify that this is an early failure but only few commented on the fact that breakdown fields in SiO_2 and SiN ~ 10MV/cm while the devices failed at lower fields confirming that this is an early failure. Prevention should focus on methods to minimize defects near the Si and dielectric interface as well as reducing trapped charges in the gate oxide.
Most of you did well in part (b) although some of you calculated F(t) rather than the failure rate in (iii)

Question 2:

I was surprised that some of you could not describe the Al-Si interdiffusion process and how it leads to failure particularly at high temperature and the pros and cons of adding Cu and Si into the Al-Cu-Si alloy (these are bookwork).
Most of you were able to draw the 2 straight lines but have not optimized the use of the graph paper. For instance ln(5600)= 8.63. So you should plot your data such that the point corresponding to t=5600 should be plotted below the value of 8.63 at the top axis.

Question 3:

I am surprised that most of you were not able to describe the working principle of SAM and parts (b) and (c) (bookwork). In part (d) note that we need to identify Cu. In this case the best technique to use will be EDX although the resolution is limited to ~1μm and it will only be suitable for atoms with high Z numbers. Cu is a metal and therefore can lead to increased generation recombination sites, leading to increased leakage current. It can also precipitates that lead to generation of dislocation.

Question 4:

Most of you who attempted this question did not describe the physical mechanisms that degrade the Si MOSFETs and GaAs MESFETs. You should be able to describe how the energetic particles interact with the oxide layer, as well as the semiconductors.
When the device dimension is reduced, the electric field will increase since the applied voltage remains the same. In addition to generation of electron hole pairs, the alpha particles can distort the electric allowing more electrons to be collected making SEUs more likely.