UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in: FYS4260/9260 Microsystems and Electronic Packaging & Interconnection Technologies
Day of exam: Wednesday, May 28th, 2014
Exam hours: 09:00 – 12:00 (3 hours)
This examination paper consists of …page(s).
Appendices: No appendices
Permitted materials: None

Make sure that your copy of this examination paper is complete before answering.

Question 1: Technology trends

a) Describe what you consider the 6 most important technology trends within electronic packaging and interconnection technology, and explain shortly for each of them why they are important.

Suggested answer: Question 1(a) in exam 2010
The development in semiconductor technology makes ever more advanced electronic systems possible. Some important trends for the systems development are:
1. Smaller critical dimensions, i.e. line widths and distances on the IC and module/PCB.
2. Increasing packaging density, i.e. more and more electric functions are possible to implement in a given area or volume
3. Increasing maximum operating frequency/bit rate
4. Increasing power dissipated per unit area and –volume
5. Increased possibility to realise complex circuit functions with standard hardware by programming software
6. Ever lower price per electrical function.

b) Please explain why is it important to select the optimal technology when starting a product development. Please provide a list of specifications and other requirements we need for the product to select the optimal technology:
Suggested answer: page 2.22 in book
All the technologies described in this chapter have their specific advantages and drawbacks, most of which will be dealt with in more detail later. Each technology has applications where they are well suited. Starting up a product development, it is

important to make technology assessments early, to pick the most suitable technology and make the design optimised for production with the chosen technology or technologies. Then the development costs can be minimised, production can be done cost-effectively, and a product with high performance/price ratio is put on the market as fast as possible.

The technology assessment should be done based upon detailed system specifications and other requirements for the product:

- *Electrical specifications*
- *Reliability and lifetime*
- *Operating and environment conditions for the product. Temperature, vibrations, electromagnetic radiation, etc.*
- *Production volume*
- *Available area/volume*
- *Maintenance and reparability considerations*
- *Acceptable price/cost level*
- *Time-to-market*
- *Etc.*

Question 2: Inorganic materials and high speed operation

a) Metals, semiconductors and inorganic insulators are a part of inorganic materials. Please explain the difference between these with respect to their electrical properties.
Suggested answer: topic 3.2 in book

b) Name and explain the most used geometries to realize transmission lines with controlled characteristic impedance on printed wiring boards and on hybrid circuit substrates. Please use both graphics and text.
Suggested answer: Question 2a in 2013 exam. See Page 6.37 in text book

Question 3: Electrical connections and IC packages

a) List the most important advantages and disadvantages of plastic IC packages and ceramic IC packages, respectively.
Suggested answer: Question 2a in 2011 exam. Page 4.15 – 4.16
NB: We realize this question can be interpreted in two ways and will accept both interpretations.

b) Explain the basic principles of vapor phase soldering for reflow soldering in surface mount technology for assembly of printed circuit boards.
Suggested answer: Question 3a in 2012 exam. Page 7.19 – 7.23 in text book

Question 4: Printing wiring boards (Unassembled printed circuit boards)

a) Describe a common used manufacturing technology for a four layer through hole plated double sided printed wiring boards. Please explain each process step briefly.
Suggested answer: Question 2(a) in exam 2009. Page 5.12 – 5.13.

b) Describe 3 different laminate materials often used in printed wiring boards, and give at least two advantages of each.
Suggested answer: Question 2b in 2009 exam. Page54.1 – 5.2

Question 4: Printing Circuit boards (Assembled printed circuit boards)

a) What is the main difference between the hole mounted technology and the surface mounted technology. Explain each of them briefly. Which one of these two technologies is suggested for increased packaging density?
Suggested answer: See page 2.1 – 2.4 in the textbook.

b) Explain a common used manufacturing technology for double sided printed circuit boards with only surface mounted devices (SMD) on one side of the board and only hole mounted devices on the other side of the board. This is best done by outlining a flow chart with a supplemental text for each step.
Suggested answer: Question 4(a) in exam 2010. See Figure 7.44 on page 7.40 in the textbook.