Overview MST courses TUDelft

Code:	Name:	EC:	Semester:
ms3011	Semiconductor Devices and Magnetism	3	2A

Detailed description of topics:

Using a few simple yet powerful quantum mechanical models, the student will become familiar with the band theory of solids and realize that therein lies the root of all materials properties exploited in modern electronic, magnetic, and optical devices. The course is focused on the application of the central theoretical results to build clever devices, all the way from the classical transistor to MEMS, nanotube devices and spintronics, rather than on the development of advanced theories. The subjects are approached from an engineering point of view, meaning that practical considerations and diverse applications get ample coverage.

wb1429-03 Microfluidics **3** **2A/2B**

Detailed description of topics:

FORMTEXT This course is an introduction to microfluidics. We start with a review of fluid mechanics theory and electrokinetics. We study the typical geometries found in microfluidic devices and discuss different methods for experimental flow characterization, i.e. microPIV. This is followed by a discussion of microfluidic devices for external and internal flow control, i.e. microvalves, micropumps and microflow sensors, and microfluidic devices for life sciences and chemistry. The course will also introduce the student to numerical methods for solving microfluidic flows.

wb1442 Introduction to micro systems **3** **1A/1B**

Detailed description of topics:

This lecture gives and introduction to Microsystems with typical sizes up to 1mm and feature sizes of a few micrometers. Overview of applications such as sensors, actuators, structural components and signal conversion. An overview of manufacture techniques, reliability, modelling, etc. relevant to microsystem design. Furthermore the physics involved in such small systems and how this differs from systems of a more traditional scale.

wb1444-05 Advanced microelectronics packaging **2** **2B**

Detailed description of topics:

As the bridge between IC and various electronics systems, microelectronic packaging controls more than 90% of the size, 60% of the cost, and largely the system performance and reliability. It is one of the most fascinating and rapid developing technology and business fields of Semiconductors. Due to the recent progress of Cu/Low-k CMOS and advanced SiP technologies, microelectronic packaging is playing a dominant role in the development of future microelectronics and Microsystems.

Course outline:

- Application needs (Ambient Intelligence drives) for Semiconductors
- Technology and business development trends of Semiconductors
- Overview of advanced CMOS process technologies (including Cu/Low-k), and advanced packaging technologies (covering the packaging glossary, design specification, materials

and properties, process flows and process characteristics for both peripheral and Area Array interconnects, etc.)
- Designing and qualification of advanced packages (QFN, BGA, FlipChip, CSP, WLP, three level SiP)
- Emerging packaging technologies, such as Cu/low-k packaging, Nanopackaging, MEMS packaging, opto-packaging and Bio-packaging
- Second level assembly

- International technology roadmap and future packaging perspectives

wb1445-05 Virtual prototyping and qualification of microelectronics and Microsystems **3** **2A**

Detailed description of topics:

The technology trends of microelectronics and microsystems are mainly characterized by miniaturization down to nanoscale, increasing levels of technology and function integration and introduction of new materials, while the business trends are mainly characterized by cost reduction, shorter time to market, and outsourcing. Combination of these trends leads to increased chances and consequences of failures, increased design complexity,decreased product development and qualification times, dramatically decreased design margins, and increased difficulties to meet quality, robustness and reliability requirements.

Most importantly, for the new product/process development, trial-error based design methods are still the common practice, while reliability qualification methods are still empirical. This situation, however, is becoming the bottleneck for the future development, especially for the advanced Cu/Low-k CMOS and higher level SiP technologies. To achieve competitive product/process development, it is vital to know and to apply the state-of-the-art of virtual prototyping and qualification.

Course outline:
- Major reliability problems in Semiconductors industries
- Status quo of current reliability paradigm
- The state-of-the-art of virtual prototyping and qualification, including the basic theories and methodologies
- Case study of covering important failure modes related with wafer backend, IC packaging and board level assembly, such as (not limited to):
- Various cracks, and delamination
- Wire bonding failures
- Solder fatigues
- Moisture-induced failures
- Warpage
- Challenges and future perspective

wb5434-05 Micro-assembly, packaging and test **3** **2A**

Detailed description of topics:

The course explains the basic principles of as well as the technology for the assembly and packaging of miniaturised products/systems. The products focused on originate both from the micro-mechanical engineering domain and from the semiconductor domain (MEMS and hybrid MEMS).
More specifically, the course addresses the following topics: classification of microsystems and the relation to assembly and packaging approaches; basic assembly principles and differences

between macro-scale and micro-scale assembly; micro-part feeding; micro-part gripping; self-adjustment; batch assembly and packagig of hybrid MEMS; general packaging flows for IC packaging and MEMS packaging; packaging architectures (including SoC, MCM, SiP); bonding techniques; wafer-level packaging; reliability and test; packaging-induced failures.

Et3204 Fysische-elektrische transductie efffecten 3 2A

Detailed description of topics:

Het woord 'Transductie' komt van het Latijns 'transducere' dat 'leidt door' betekent. In dit onderdeel duidt dat op het doorleiden van een signaal van het ene energiedomein naar het andere, transductie is de interactie tussen signaaldomeinen.
Het onderdeel geeft de aankomende elektrotechnische ingenieur een breed overzicht van fysische signaalomzettingen. Het warm worden van een condensator of drift in een elekrotnische schakeling kan niet verklaard worden zonder kennis van transductieeffecten. De zes signaaldomeinen zijn: Straling, Thermische, Mechanisch, Chemisch, Elektrisch. Er worden hoorcolleges en practica gegeven. In de colleges worden de interacties uitgelegd. Hierin wordt het pad bewandeld van de macrowereld naar de microwereld en dan weer naar de macrowereld. We dalen af tot het niveau van elektronen en banden, waarmee het transductieeffect verklaard kan worden.
Twee ochtenden worden gereserveerd voor practica. De practica geven de student zelf de kans om met transductieeffecten te werken. Het probleem van storing, verlies en beperkingen van signalen wordt door experimenten ondervonden. Elk practicumdeel vereist een gedegen voorbereiding van de uitgedeelde opdrachten.

ET4250 Integrated Circuit Technology 4

The aim of this IC technology course is to give students a good insight in the basic process steps i...

ET4257 Silicon Sensors 4

The course silicon sensors gives an overview of the most important principles related to sensors fabricated in integrated silicon technology. The sensors are divided into those for optical, mechanical, thermal, magnetic and chemical signals. A Special topic in this course is that of CMOS image sensors. This part of the course will deal with the most important principles, possibilities and limitations of image sensors which are fabricated in a standard CMOS proces. All different imaging aspect of the solid-state image sensors ranging from "photons in" till "digital numbers out" will be studied. Special attention will go to the combination of the imaging function with the analogue and digital circuitry on-chip. The course is designed for students who will perform their thesis work in one of the laboratories within the faculty working on or using sensors.

ET4258 Displays and Actuators 4

Het college Displays en Actuatoren geeft een overzicht van de belangrijkste principes die in moderne displays en actuatoren worden toegepast. Externe computergeheugens en printers komen ook aan de orde. Bijna elke elektrotechnische ingenieur krijgt in de praktijk met displays te maken en door de veelheid van mogelijkheden is het niet eenvoudig een juiste keuze te maken. Zo is de vraag of alle toekomstige personal computers met liquid crystal displays zullen worden uitgerust, op het moment zeer actueel en aan deze vraag zal daarom op het college de nodige aandacht worden besteed. Met behulp van de silicium technologie worden diverse actuatoren in silicium gemaakt. Deze nieuwe technologie en gemaakte structuren worden

behandeld. In het kader van de onderzoekschool DIMES wordt binnekort een onderzoekproject op het gebied van LCD projectiedisplays gestart.

ET4ICP Technology Lab. **2**

During seven half days students will have the opportunity to gain practical experience in the proces...