HOCHSCHULE
DER MEDIEN

IT NUMBER		MODULE	SCOPE	EXAMINATION
PL: 181141	**Material Sciences**	**7**	**9**	**PL: KL, 90 Min.**
PV: 181142				PV: LT
181141b	Material Sciences II	5	6	PV

Material sciences is split into several sections build one upon another, which include:

- Colour & Inks;
- Adhesives & Polymers;

The course starts with an introduction into atomic and orbital structures followed by an introduction into organic chemistry. The lecture focuses on scientific and engineering aspects of papermaking from wood to fibre through pulping, conditioning, paper-making and converting.

In a second step mechanisms of adhesion, wetting and spreading are covered. Students will learn how to determine surface energy values of solids and liquids. They will study adhesive formulations, bonding mechanisms, mechanical properties of structural adhesives and the chemistry of adhesives used in the printing and packaging industry. The course covers pigments, ink chemistry and vanishes followed by a lecture on polymer chemistry.

Week 1

For this week your task is to learn more about the structure of atoms. You will study how to use the Bohr model and the equations introduced to describe energy levels of different electron shells. You will touch wave particle-duality.

Week 2

The following session is about quantum wave functions and orbitals. We have a look at Schrödinger's famous wave function and will focus on quantum numbers. You will understand the orbital model which gives us the modern Periodic System of elements. You learn about the Aufbau system, nomenclature and 'electrons in boxes'.

Week 3

During this week we will look at atom and molecular orbitals as well as at bonding and antibonding forces. You will learn how to develop and read LCAOs. The lecture includes sections on hybridization and electronegativity. We will look at covalent, polar and ionic bondings and you will learn about one of the reasons for intermolecular forces.

HOCHSCHULE
DER MEDIEN

Week 4 and 5

As you look around you, you will be aware of many different colours – from the greens and browns outside to the bright blues and reds of the clothes you are wearing. All these colours result from the interaction of light with the pigments in these different things – some frequencies of light are absorbed, others scattered. Inside our eyes, chemical reactions detect these different frequencies and convert them into electrical nerve impulses and send them to the brain. This session is about colour and pigments. It is a lengthy session which is meant for students to pick just important information and to create a structure of the subject. This must be reflected in the learning diary.

Week 6

One of the most difficult aspects of developing reliable printing ink systems is creating a stable dispersion of particles within the ink. This applies to inks containing pigments for colour applications but equally to inks containing other particles for functional deposition applications, which are becoming increasingly important. The issue of dispersion is subject of this lecture. Students will learn about stable dispersions and the ingredients of printing inks. The physical and chemical stabilization mechanism are discussed. The second part of this week's lesson includes the composition of different printing inks systems and their requirements

Week 7

In a perfect world, you would be able to create artwork, expose a screen, and print the graphic with no loss of image integrity. Unfortunately, the reality is that something usually gets lost when the image progresses from one stage to the next. Dots become larger or smaller. Colours in the printed image don't match the artist's intent. And data that appear acceptable make it difficult to process and print. However, you can identify and control these problems by using densitometers and spectrophotometers. Densitometers give you the power to quantify quality throughout the screen-printing process. Whether you want to control film densities from outside sources, match colour proofs supplied by your customer, or spot check colour consistency in the middle of a production densitometry helps to improve prints on any form of substrate, from textiles to compact discs. Measuring pantone colours however requires colourimetry. This session is about densitometry and a short introduction into colourimetry, what it is and how the human eye works.

Week 8

A range of colours can be created by the primary colours of pigment and these colours then define a specific colour space. Colour space, also known as the colour model (or colour system), is an abstract mathematical model which simply describes the range of colours as tuples of numbers or colour components (e.g. RGB). This session is about the basic ideas of the development of a standard colour space. A colour space is a useful method for printers to establish a colour management system for the reproducibility of print media and for colour-proof printing. There are a variety of colour spaces, such as RGB, CMY, HSV, In this session we will talk about the Munsell colour space, the CIE XYZ colour system and the xyY chromaticity diagram.

Week 9 and 10

The CIE system characterizes colours by a luminance parameter Y and two colour coordinates x and y which specify the point on the chromaticity diagram. Based on the fact that the human eye has three different types of colour sensitive cones, the response of the eye is best described in terms of three tristimulus values. However, once this is accomplished, it is found that any colour can be expressed in terms of the two colour coordinates x and y. The XYZ colour space is used for the development of a perceptual equidistant colour space. This session is about different CIE colour spaces commencing with the XyY chromaticity diagram followed by the Uniform Colour Space, the CIELUV and finally the CIE L*a*b* colour system. A perceptual equidistant colour space is discussed and developed. Three colour differencing equations are discussed.

Week 11, 12 and 13

Adhesives are as diverse as the various materials they hold together. And because they are so central to the quality, safety and functionality of objects ranging from food packaging to airplanes, developing adhesives demands highly specific knowledge of different segments and processes. The following four sessions are about the chemistry, workings and application of synthetic adhesives used in printing applications and beyond.

Week 14

Test exam

Week 15

Excusion