

## SYLLABUS: MATERIAL SCIENCE

**Date / Revision** 15 August 2017 / 02 May 2017 / MaS  
**Faculty** Engineering and Lifesciences  
**Study Programs** AVE, AUE, COS, MEE, INE, ELE, MTE, FTE, CHE, BME

### SUBJECT: Material Science

#### 1 Basic Information

<b>1.01</b>	<b>Subject Name</b>	<b>Material Science</b>
<b>1.02</b>	<b>Semester</b>	1
<b>1.03</b>	<b>Level</b>	1
<b>1.04</b>	<b>SKS</b>	2
<b>1.05</b>	<b>Mandatory / Curriculum</b>	F-03
<b>1.06</b>	<b>Subject Code</b>	MATS
<b>1.07</b>	<b>Subject Code</b>	ENG-F-MATS-113
<b>1.08</b>	<b>Year</b>	2017 (7)
<b>1.09</b>	<b>Quality Control</b>	Final Test, see evaluation
<b>1.10</b>	<b>Limitations</b>	Min 12 and Max 32 students in one class
<b>1.11</b>	<b>Combined with</b>	AVE, AUE, COS, MEE, INE, ELE, MTE, FTE, CHE, BME
<b>1.12</b>	<b>Perquisite</b>	None
<b>1.13</b>	<b>Responsible</b>	Dipl.-Ing. Wahjoe Goeritno M.Si
<b>1.14</b>	<b>Revision</b>	15-08-2017/MaS

#### 2 Description of Subject

This course is intended for students who do not have a materials science and engineering background. The course will cover four major topics including: fundamental concepts, microstructure development and phase equilibria, material properties and fabrication methods and applications. The course will cover atomic structure, atomic bonding, crystal structures, defects, and diffusion in materials. It also will cover phase equilibria and how they impact microstructure development. The electrical, magnetic, optical, thermal, and mechanical properties of materials will also be reviewed. The course will also highlight modern fabrication technologies and applications of metals, ceramics, semiconductors, and polymers

### 3 Objectives

- The aim of this course is to evaluate the fundamentals of Materials Science and Engineering and to examine the application fields

### 4 Competency

After having the course, students are expected to:

- Have basic knowledge of selecting material for certain application by knowing its properties
- Have understanding the type of atomic structure and type of bonding
- Have the knowledge of crystal structure that build the material
- Be able to do simple calculation in diffusions of carbon in Steel.
- Be able to read and understand the Steel phase diagram.
- Have the knowledge of steel application and processing.
- Understand the polymers: the built of polymer, properties, application and processing

### 5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Circuit simulation using Electronic Workbench Software;
- Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

### 6 Evaluation

5.1	Absence maximum	25%
5.2	Participation in Discussion	05 Points
5.3	Homework / Classwork	05 Points
5.4	Presentation /Simulation	10 Points
5.5	Daily Quiz	20 Points
5.6	Final Examination	60 Points
	<b>Total</b>	100 Points

### 7 Text Book and Reference

- Main Text Book:**  
"Material Science and Engineering, an Introduction", **Authors:** William D. Callister, David G. Rethwisch, **Publisher:** John Wiley and Sons Inc, **ISBN:** 0-471-39551-X

<b>2</b>	<p><b>Supplement Textbooks:</b></p> <ul style="list-style-type: none"> <li>• “Material Science and Engineering, a First Course”, <b>Author:</b> V. Raghavan, <b>Publisher:</b> Prentice Hall India Learning Pvt. Ltd, <b>ISBN:</b> 978-8120324558</li> <li>• “Introduction to Physical Metallurgy, 2 Editions”, <b>Author:</b> Avner, S. H., <b>Publisher:</b> McGraw Hill Higher Education-New York, <b>ISBN:</b> 978-0070024991</li> </ul>
----------	--

<b>8</b>	<b>Content / Topics of Lecture</b>
----------	------------------------------------

Week	Content/ Topics of Lecturing	Text Book	Remark
1	<b>Introduction to Material Science:</b> Types of Material, Different level of structure, Processing, Structure, Properties, Performance	Ch1	
2	<b>Atomic Structure and Bonding:</b> Atomic structure, Atomic bonding in solid, Ionic, Covalent, and Metallic bond. Van der Waal bonds.	Ch2	
3	<b>Structure of Metals:</b> Crystal structure SC, FCC, BCC, HCP. Atomic packing factor, Density calculation. Crystal System Cubic, Tetragonal, Orthorombic. Single crystal, Poly crystal, Cystalline and Non Crystalline.	Ch3	Quiz
4	<b>Defect in Solids:</b> Vacancies and Self interstitial, Impurities in Solids. Dislocation – Linear Defect, Interfacial, bulk and Vlume defect.	Ch4	
5	<b>Diffusions:</b> Diffusion mechanism, Steady Staet Diffusions, Non Steady State Diffusions, Factor influencing the Diffusion.	Ch5	Quiz
6	<b>Mechanical Properties of Metal:</b> Concept of Stress and Strain, Stress Strain behaviour, Elastic properties of Material.	Ch6	
7	<b>Mechanical Properties of Metal:</b> Tensile properties, Elastic recovery, Shear, Torsional and Hardness.	Ch6	Quiz
8	<b>MIDTERM SEMESTER BREAK</b>		
9	<b>Phase Diagrams:</b> Solubility limit, Phases, Phase Equilibria, Binary Isomorphous System, Binary Eutectic System.	Ch9	
10	<b>Phase Diagrams:</b> The Iron – Carbon System: The Iron – Iron carbide Phase Diagram, Development of Microstructure in Iron – Carbon Alloys, The Influence of other Alloying Elements.	Ch9	

11	<b>Application and Processing of Metal Alloys:</b> Types of Metals Alloys, Ferrous, Non Ferrous Material. Thermal Processing of Metals.	Ch11	Quiz
12	<b>Polymer Structures:</b> Hydrocarbon Molecules, Polymer Molecules, Molecule Weight, Thermoplastic and Thermosetting, Copolymer.	Ch14	
13	<b>Characteristics, Applications and Processing of Polymer:</b> Mechanical Behaviour of Polymer, Mechanism of Deformation and Strengthening of Polymer, Crystallization, Melting and Glass Transition Phenomena in Polymers, Polymer Types, Polymer Synthesis and Processing.	Ch15	
14	<b>Electrical Properties of Material:</b> Electrical conduction, Semi Conductivity, Eletrical Conduction	Ch18	Quiz
15	<b>Thermal Properties:</b> Heat Capacity, Thermal Expansion, Thermal Conductivity, Thermal Stress	Ch18	Task and Prsentation
16	<b>FinalExamination</b>		