

## Methodological Conception and Modular Structure for the Development of Training Modules

Jürgen Wehling<sup>1</sup>, H. Güçlü Yavuzcan<sup>2</sup>

<sup>1</sup> Dr.-Ing. Jürgen Wehling  
e-mail: [juergen.wehling@uni-due.de](mailto:juergen.wehling@uni-due.de)  
Faculty for Engineering Sciences,  
Department of Technology (Lectureship)  
Technology and Didactics of Technique,  
University of Duisburg-Essen, Campus Essen,  
Universitaetsstr. 15, D-45141 Essen, Germany

<sup>2</sup> Prof. Dr. H. Güçlü YAVUZCAN  
e-mail: [gyavuzcan@gazi.edu.tr](mailto:gyavuzcan@gazi.edu.tr)  
Gazi University, Department of Industrial Technology Education  
TR-06830 Gölbaşı, Ankara, Turkey

**Keywords:** modular structure, methodology, conception, main module, objectives

### ABSTRACT

Assembling a modular system is one of the main tasks of the European project “Modular TE”. This task was fulfilled by the creation of a special methodological approach for the development of modules. Based on the “Comments about the interviews of Experts” and on a known system theoretical approach a methodological conception was developed and provided. This conception led directly to a modular system which was enhanced systematically concerning its structure and modified strictly concerning its content. The implemented modular structure is based on five so called “Main Modules” which are covering the essential areas of technology education. One Main Module itself consists of a couple of modules which are covering important areas bound to curricular items. Each of these modules is described by so called “subject areas”. These areas in turn are a summary of content bound items. They can be found in the related lectures subsequently. Because every module itself consists of two or three lectures, the subject areas are compulsory for building lectures. Each lecture was given a certain amount of credits concerning the European credit transfer system (ECTS) to prepare a straightforward integration into further development of European standards on technology education for general school.

### 1. INTRODUCTION

It should be well known that the general objective of the European project “Modular TE” is to “develop innovative approaches in terms of quality assurance in technology education and to adapt the content and supply of technology education to suit new qualification needs (ICT, work related training etc.) under a flexible curriculum through cooperation between educational and professional establishments in Europe”. Regarding the conclusions and recommendations of “Comments about the interviews of Experts” (Theuerkauf, 2006) it is clear that technology education has to cover a really wide range of subject areas, i.e. material, energy, information and socio-technology and last but not least didactics of teaching technology. The core on technology education seems to be a certain teacher training for the improvement of engineering, didactical and practical skills. This has to include basic knowledge about technical systems as well as processes of real life. By considering the very fast ongoing of new technologies like internet based approaches (i.e. Web 2.0) we face a situation with permanent new challenges and changes in dealing with elements of ICT only.

Other areas like work related training for sure have overlapping elements concerning ICT. A lot of well done approaches of the past are no longer contemporary. We also have to consider that in most European countries the fundamentals of technology education are a kind of applied natural sciences or they are integrative elements of them. This means that technology education is mainly imparted by science. It is inevitable to create a new curriculum for technology education that integrates aspects of typical training elements concerning technology and it has to be flexible enough to be valid “on the fly”. This aim can only be reached by creating a modular system with a flexible structure as a basis for the development of a new curriculum. This can be done by this pilot project because one is for sure: the implementation of technology education in Europe could be accelerated by a significant contribution of the European project “Modular TE” emphasizing the so called “New Approach”.

## 2. BACKGROUND INFORMATION

“The Bologna Process stresses the European cooperation in quality assurance.” This sentence describes some essentials of the project’s summary: we have to consider the results of the Pisa study as well as to ongoing of the Bologna process which will cause some important changes on the landscape of European universities, i.e. Bachelor and Master studies. The “Modular TE” project is a mainstream project and as a pilot project it is one first step in the right direction and it is for sure that further steps will follow. A glance at the project’s proposal shows that it is separated in a couple of packs called work packages 1 to 8 (WP1 – WP8). Some of these packages are covering the whole project period others are time limited in between the projects frame. Basing on the results of WP3 (Background analysis of technology education programs - Identification of current training needs and new qualification needs) it is necessary to have a certain glance on some essential subjects of technology education which were stressed by the participants of the questionnaires.

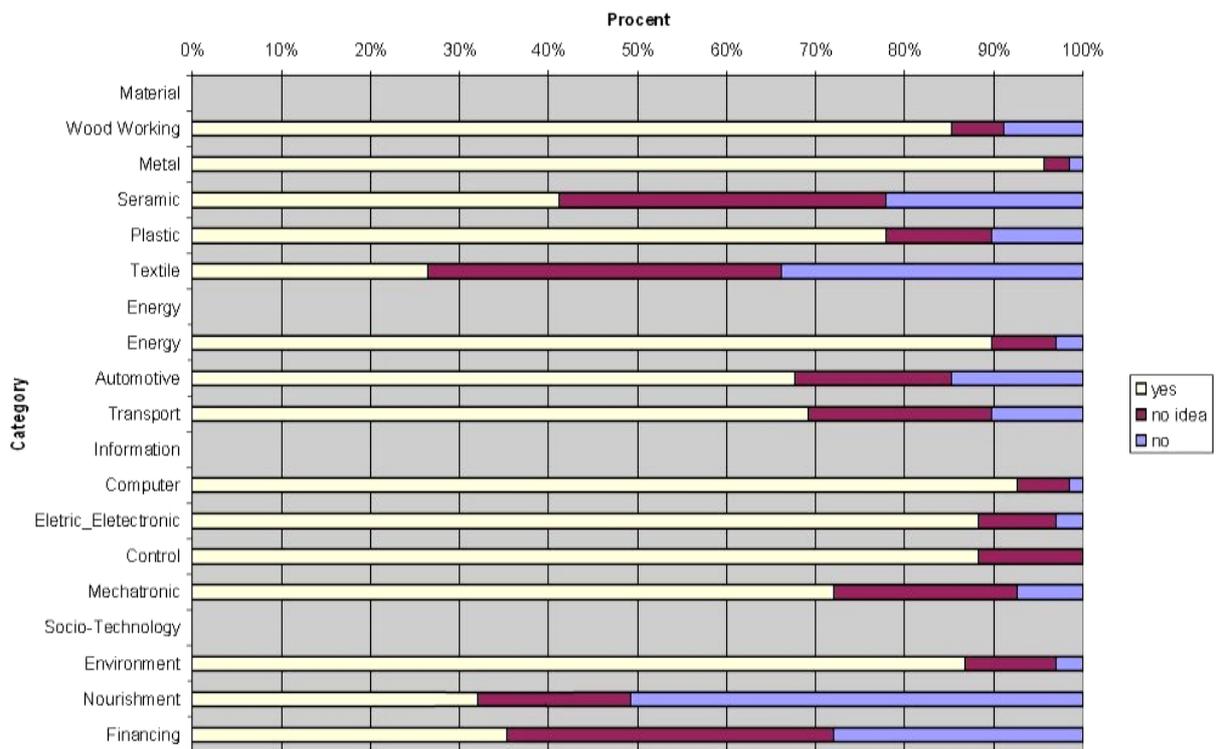
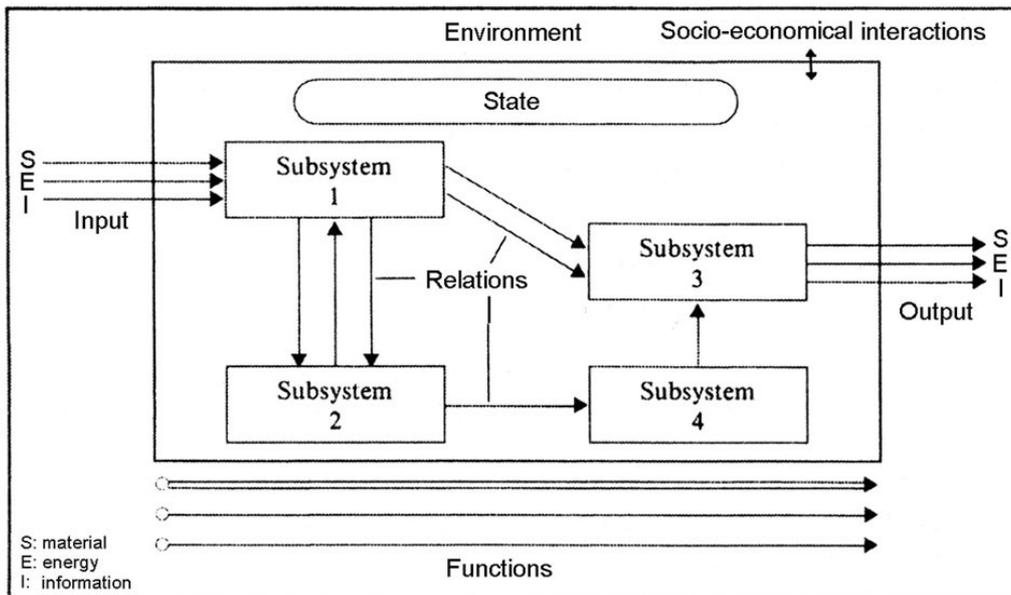


Figure 1: Subjects of technology education

The results of the questionnaires show that especially the answers for desired teacher raising programmes are strictly oriented at the topics of material, energy, information and socio-technology as shown in Fig. 1 (ModularTE, 2007).

The identifying of 4 essential topics by the assessment of the questionnaires was extremely useful for the further planning of assembling a reliable structure for the development of a methodological conception. The only thing that was left was the integration of didactical elements.

According to a system approach with cybernetic elements a system model of technology education can be found. This is Ropohl's approach of a system for general technology (Ropohl, 1999). This approach is shown in Figure 2 below and it is for sure well known.



*Figure 2: System model of general technology*

### 3. DEVELOPMENT OF A METHODOLOGICAL CONCEPTION

Work package 4 (development of methodology) of the project was mainly the task of the university of Duisburg-Essen (UDE). The central purpose of this project's part was to provide a methodology for the development of modules that can serve as a basis for developing training programs for technological education on European level.

The evaluation of the regional reports and the statements of the consulted experts that were presented at the conference at Larissa will provide the basis for defining contents of general importance. These contents will then be incorporated into modules, which all project partners could integrate into their current courses of training.

Following both the guidelines for technological education as described in the regional reports and the experts' opinions on tendencies concerning the modules' form, contents, and organization, we have identified and specified a number of themes of general importance. In accordance with the request under WP3, we have included some regional courses that we considered as suitable elements for the development of further modules. We have asked the

partners mentioned there to provide us with an English version of their contents for about four teaching units of their respective courses.

All modules to be developed will be assigned to one of the following fields:

- Compulsory technical modules (for teacher education and polyvalent profiles)
- Compulsory pedagogical modules (for teacher education)
- Modules (subject/ fields) for gaining competences of vocational guidance

The purpose hereby was to develop a methodological approach for the prototyping of five Main Modules (this decision was made in accordance to the “Comments about the interviews of Experts”

**Main Module 1: Fundamentals**

**Main Module 2: Technological systems and processes**

**Main Module 3: Information and communication**

**Main Module 4: Socio-technology**

**Main Module 5: Didactics**

Each of these Main Modules mentioned above has certain properties like: basic conception, description, related subjects. These elements can be described in a general form as follows:

### ***3.1. Basic conception of Main Modules***

Technological decision-making and responsibility mainly presumes a systemic thinking and acting especially in the context of interlaced structures concerning technological systems and processes from the areas of material, energy and information in context with socio-technical and didactical elements. The focus of all Main Modules is set to the ability of reaching appliance oriented competencies in all the areas mentioned above. The central aim, concerning subjects as well as didactical and methodological elements therefore is the procurement of technological decision-making and responsibility (Richtlinien und Lehrpläne, 1999). It has to be considered that Main Module 2 and Main Module 3 are of deep interest, because they are mirroring some important aspects of a system model based on an approach of general technology. Surrounded by socio-technological intended elements the didactics of teaching technology sets an enclosed bracket all around the system (see figure 2).

### ***3.2. Description of Main Modules***

The systematic structure of each Main Module can be organized by suitable model approaches for classification systems. For instance the Main Module 2, “Technical Systems and Processes” has an inner structure, which is in accordance to the functions of “Transformation-Transport-Storage” concerning the attributes “Material-Energy-Information”. This scheme is a typical scheme for technological systems (Ropohl, 1999). Herewith you can build a so called “Attributes-Function-Matrix”. This matrix has the ability to give an overview about corresponding elements which can be put together by areas of “Supply and Disposal” as well as “Transport and Traffic”.

### ***3.3. Related subjects of Main Module 2 (see figure 3)***

*Area: Supply and Disposal*

*Function: Transformation*

*Attributes: Material, Energy*

Computer Aided Manufacturing (CAM), Material Processing Technologies, Metal Forming, Plastic/Ceramic Technologies, General Technology (Energy Transformation), Mechanics, Working Machines and Electricity Producing Systems

- *Area: Transport and Traffic*
- *Function: Transport, Storage*
- *Attributes: Material, Energy*

Basic of Constructing, Means of Transport and Equipment, Mechanics

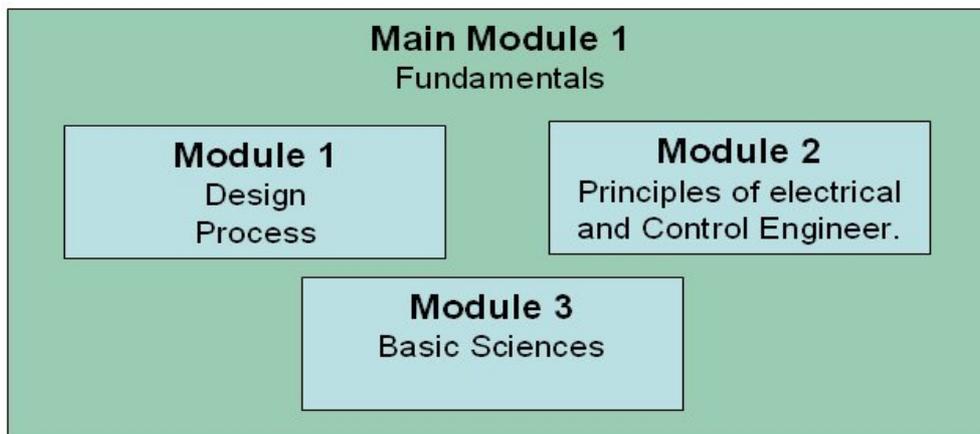
The descriptions of all 5 Main Modules constitute a central part in the conclusion with work package 4 of the project. They will serve as a basis for the further elaboration of single units in order to specify the contents of all Main Modules (work package 5).

Functions =>	Transformation	Transport	Storage
Attributes			
Material S	<b>Supply and Disposal</b>	<b>Transport and Traffic</b>	
Energy E			
Information I	<b>Information and Communication</b>		

**Figure 3: Attributes-Functions-Matrix**

### 3.4. Each Main Module consists of several Modules

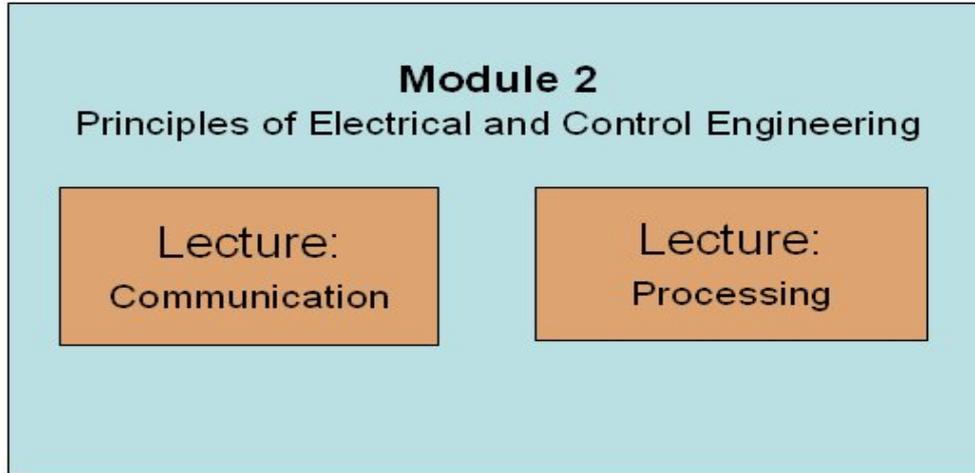
The assembly of a Main Module, i.e. Main Module 1, “Fundamentals”, contains a couple of modules generally (Wehling and Haupt, 2001). These modules are exactly related to the theme of the accordant Main Module. Therefore the modules 1 to 3 are covering a wide range concerning fundamental elements like “Design Process” (technical drawing, CAD, material science, etc.) or “Principles of electrical and Control Engineering” (communication, processing, etc.) as well as “Basic Sciences” in i.e. mathematics and physics.



**Figure 4: Assembly of a Main Module 1 consisting of 3 modules**

### 3.5. Each Module consists of one or more Lectures.

The assembly of a module, i.e. module 2, “Principles of electrical and Control Engineering”, contains at least 2 lectures (see figure 5). These lectures again are exactly related to the theme of the corresponding module. Therefore the lectures Communication and Processing are covering a wide range concerning elements of technologies for communication basics as well as the processing of analogue and digital data.



*Figure 5: Assembly of module 2 consisting of 2 lectures*

### 3.6. Each Lecture consists of a couple of elements taken from a list with related subjects (subject area)

The assembly of a lecture, i.e. “Communication” or “Processing” of module 2, contains a couple of topics from the subject areas (see figure 6). The subject oriented areas are a kind of repository containing all important subjects related to the corresponding Main Module. From this area necessary subjects or subject areas are to be taken to build a complete lecture. The subjects are specified by themes that have, depending on the lecture different foci (key aspects). The lecture “Communication” can be intensified by making use of elective elements like “Probability and random Variables” or “Random Processes”. The use of elective elements depends on the structure of the course given by the prerequisites of the students.

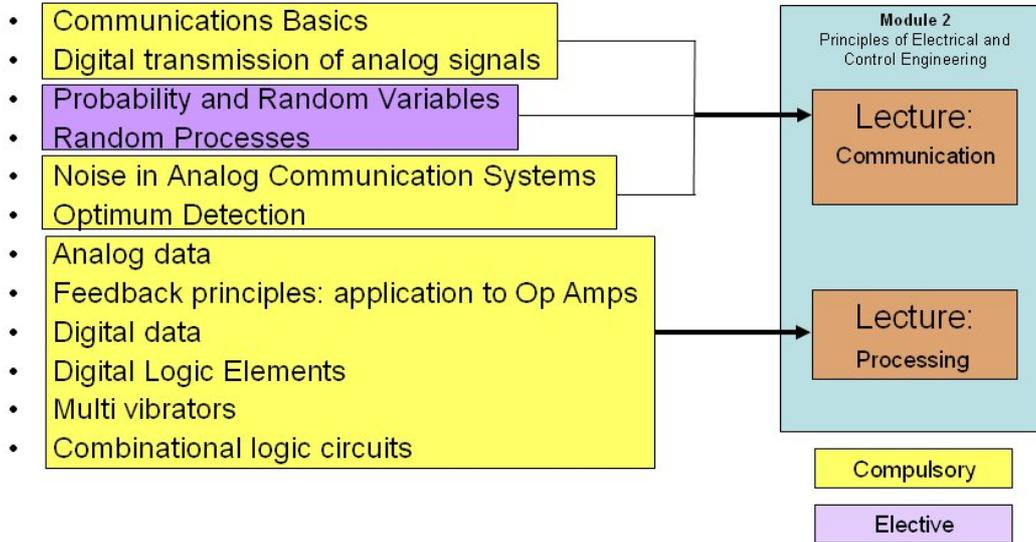
## 4. DEVELOPMENT OF THE MODULAR CONCEPTION

Table 1 shows the position of a Main Module in context with related topics and it shows the activities of the partners as well as the final version of the overall system. In this table is also included the amount of credit points concerning ECTS. The abbreviations used are as follows (in order of appearance):

- STEP: Stage within European Programmes, Spain
- AF: Aries Formazione, Italy
- UDE: University of Duisburg-Essen, Germany
- GU: Gazi University, Turkey
- VTU: Tador Kableshkov VTU, Bulgaria
- EFC: Euroface Consulting, Czech Republic
- CVT: Georgiki Anaptixi, Greece

**Subject oriented thematically enclosed list**

**(subject areas):**



*Figure 6: Assembly of two lectures consisting of subject area related topics*

*Table 1: Main Modules 1-5 in context with corresponding partner activities*

MAIN MODULE	PARTNER ACTIVITIES				CTS
MAIN MODULE 1: FUNDAMENTALS	<b>STEP</b> DESIGN PROCESS 18 CTS	<b>AF</b> ELECTR. & CONTROL ENG.,6 CTS	<b>STEP</b> BASIC SCIENCES 6 CTS		30 CTS
MAIN MODULE 2. SYSTEMS AND PROCESSES	<b>UDE</b> GENERAL TECHNOLOGY/ ENERGY TRANSFORM. 4 CTS	<b>GU</b> MATERIAL PROCESS. 15 CTS	<b>VTU</b> MACHINE & PRODUCT ENG. I 12 CTS	<b>EFC</b> MACHINE & PRODUCT ENG. II 3 CTS	34 CTS
MAIN MODULE 3. INFORMATION COMMUNICATION	<b>UDE</b> INFORMATION COMMUNICAT.				23 CTS
MAIN MODULE 4. SOCIO- TECHNOLOGY	<b>CVT + AF</b> ENVIRONM. SYSTEMS I 4 CTS	<b>CVT</b> ENVIRONM. SYSTEMS II 4 CTS			8CTS
MAIN MODULE 5. DIDACTICS of TECHNOLOGY	<b>UDE</b> DIDACTICS				8 CTS

The calculations have been done basing on 160 credits for the whole curricula. To provide the flexibility of the modular structure; the partners have agreed in the 4<sup>th</sup> Steering Committee meeting (in February 2007) that, 30 credits should be remained for the electives that would be consistent with the national technology education policies of the individual European countries. This can be done either by intensifying on the created modules (i.e. increasing the credits of the existing courses in the curricula) or by adding new courses or modules in the curricula as consequences of extensive needs proven by national authorities.

Apart from this, 27 credits have been left for the courses and practices regarding the general pedagogical approaches. The experiences from the country reports showed that the pedagogical approaches and authorities for certifying the teaching profession differ among the partner countries. Thus, to increase the applicability of the curricula, the partnership decided not to make approaches on this issue.

## 5. ASSIGNMENT OF CREDITS

Table 2 shows the Main Modules 1 to 5 in context with the related lectures. The number in brackets behind each lecture shows the amount of credits in accordance to ECTS. 3 Credits are 75 hours (1 credit = 25 hours of student workload). For a course of 3 credits, a maximum of 45 hours lecture is assumed to be performed for regular semester of 15 weeks. The remained hours are allocated to other “teaching method” categories on the basis of the assumed student workload in the related course by the field experts. Figure 6 shows an example of the lecture “Information Transformation III” from Main Module 3, “Information and Communication”. This one is called “Processor oriented Programming”.

**Title of the Course: Information-Transformation III - Processor oriented programming**

Semester	Main Module	Module	Teaching Methods (Student Workload)								Credit
			Lecture	Recite	Lab.	Project	Homework	Field study	Other	Total	
6	3	3	25	15	25		10			75	3

*Figure 7: Dissemination of 3 credits by student's workload*

## 6. DISTRIBUTION OF COURSES INTO SEMESTERS

Table 2 shows the Main Modules 1 to 5 in context with accordant lectures. For instance; Main Module 4 “Socio-Technology” consists of 2 modules called “Environmental Systems I” and “Environmental Systems II” with completely different contents: module 1 again consists of two lectures: “Historical Aspects of Technology” (designed by the Italian partner) and “Socio-Technological Systems” (designed by the Greek partner); module 2 again consists of two lectures which were both also designed by the Greek partner: “Environmental Systems” and “Evaluation of Consequences”.

## 7. DISTRIBUTION OF LECTURES INTO SEMESTERS

By regarding Table 3 concerning the distribution of lectures into semesters, it is necessary to consider the following correlations:

- “Technical Drawing I” is prerequisite for “Technical Drawing II”, this is a prerequisite for CAD. CAD is prerequisite for “Technical Processes and Products” (CIM)
- “Communications” and “Processing” are prerequisites to Introduction in Main Module 3
- “Mathematics” and “Physics”, are prerequisites for “Mechanics”
- “Mechanics” and “Material Science” are prerequisites to “Basic Construction”
- “Material Processing Technology I” is prerequisite for “Material Processing Technology II”
- Each “Information-Transformation” is prerequisite for the following I/II/III/IV/V

## 8. THE ECTS FORM FOR COURSE DEFINITIONS

The theme of ECTS was touched former in this document and will be explained at this place. One of the courses of the Italian partner is chosen as an example: “Electrical Engineering” (Figure 8). It has to be considered, that this course consists of two lectures put together to one course. This course can be found under Main Module 1 (MM1), “Fundamentals” in module 2, “Principles of electrical and Control Engineering”.

In each course; followed by the teaching methods, the objectives that are the specific statements of the teaching intention were given. During the definitions of the individual courses; the experts of the partner countries in the related fields have given a special importance for achieving the learning outcomes (statements of what a student is expected to know, understand and/or be able to demonstrate after completion of a process of learning). As one of the main concepts of the Bologna Process, the use of learning outcomes as a type of common language for describing the qualifications clearer to other institutions, employers and those involved in evaluating qualifications.

The teaching method is a blend of lecture, laboratory, homework and seminar that are leading all together to a student’s workload of 150 hours. These 150 hours are equivalent to 6 credits. As mentioned before, one credit is equivalent to 25 hours student workload. It is also fixed, if the course is elective or compulsory. Additionally the prerequisites, the objectives, the learning outcomes and the biographical references are described. The assessment criteria for this course are done by 30 percent of laboratory work and by 70 percent of a final exam. Last, but not least, the course contents are listed.

For obtaining the learning outcomes Bloom’s taxonomy for writing the learning outcomes in the cognitive dimension was considered (Kennedy, 2007). Thus, the six increasingly complex levels of thinking (knowledge, comprehension, application, analysis, synthesis and evaluation) have been emphasized during the studies.

**Table 2: Main Modules 1-5 in Context with Accordant Lectures**

<b>MAIN MODULE 1: FUNDAMENTALS</b>		
MODULE 1	DESIGN PROCESS	Technical Drawing I (3), Technical Drawing II (3), CAD (2) Basic Design Principles and Modelling (3) Exposition & Documentation (2) Material Science (3), Technology Process & Products (2)
MODULE 2	PRINCIPLES of ELECTRIC. and CONTROL ENGINEER.	Communication (3) Processing (3)
MODULE 3	BASIC SCIENCES	Mathematics (3) Physics (3)
<b>MAIN MODULE 2: SYSTEMS AND PROCESSES</b>		
MODULE 1	MATERIAL PROCESSING TECHNOLOGY	Manufacturing Processing, Technology I (3) Manufacturing Processing, Technology II (3) CAM (3), Welding & Sheet (3), Plastic & Ceramic Tech (3)
MODULE 2	GENERAL TECHNOLOGY/ ENERGY TRANSFORM.	GT/ET (3) Practical in Energy Transformation (1)
MODULE 3	MACHINE & PRODUCT ENGINEERING I	Basics of Constructing (5), Mechanics (5) Transport Equipment (2)
MODULE 4	MACHINE & PRODUCT ENGINEERING II	Working Machines & Electricity Producing Systems (3)
<b>MAIN MODULE 3: INFORMATION AND COMMUNICATION</b>		
MODULE 1	FUNDAMENTALS	Introduction (2) Basics – Analogue P1 (1), Basics – Digital P2 (1)
MODULE 2	APPLIED CONTROL TECHNOLOGY	Basics – Analogue P2 (2), Basics – Digital P2 (2) Information/Transformation I (2)
MODULE 3	PROGRAMMING OF SOFT- and HARDWARE	Information/Transformation II (2) Information/Transformation III (3)
MODULE 4	NETWORKING TECHNOLOGIES	Information/Transformation IV (2) Information/Transformation V (3)
MODULE 5	PRACTICAL TRAINING	Laboratory I (1), Laboratory II (1)
<b>MAIN MODULE 4: SOCIO-TECHNOLOGY</b>		
MODULE 1	ENVIRONMENTAL SYSTEMS I	Historical Aspects of Technology (2) Socio-technological Systems (2)
MODULE 2	ENVIRONMENTAL SYSTEMS II	Environmental Systems (2) Evaluation of Consequences (2)
<b>MAIN MODULE 5: DIDACTICS OF TECHNOLOGY</b>		
MODULE 1	INTRODUCTION I	Introduction to Didactics of Technology I (2)
MODULE 2	PRACTICAL TRAINING I	Practical School Training I (2)
MODULE 3	INTRODUCTION II	Introduction to Didactics of Technology II (2)
MODULE 4	PRACTICAL TRAINING II	Practical School Training II (2)

**Table 3: Distribution of lectures into semesters**

S	Main Module 1	Main Module 2	Main Module 3	Main Module 4	Main Module 5	CTS
1	Maths (3)					15
	Tech. Draw. I (3)					
	Basic Design Pr. (3)					
	Comm. (3)					
	Processing (3)					
2	Physics (3)		Introduction (2)	Historical Aspects (2)		13
	Tech. Draw. II (3)					
	Material (3)					
3	CAD (2)	GTET (3)	Basic Inf. (3)			16
	Exp. & Doc. (2)	Mechanics (5)	Practice I (1)			
4	Tech. Process & Products (2)	Welding (3)	Basic Dig. (3)			13
		Plastics (3)	Inf.-Trans. I (2)			
5		GT/ET practice (1)	Inf.-Trans. II (2)		Introduction to Didactics of Technology I (2)	8
		MPT I (3)				
6		MPT II (3)	Inf.-Trans. III (3)		Practical School Training I (2)	13
		Basic Const (5)				
7		Transportation (2)	Inf.-Trans. IV (2)	Socio-tech. Systems (2)	Introduction to Didactics of Technology II (2)	16
		Working Machines (3)		Environmental Systems (2)		
		CIM (3)				
8			Inf.-Trans. V (3)	Evaluation of Consequences (2)	Practical School Training I (2)	9
			Practice II (2)			

## 9. FINAL REMARKS

The system-theoretical approach of Ropohl was only one of the important impulses for the development of a methodological structure. Another approach was given by Bloom's taxonomy of learning outcomes and objectives. This is shown in the publication for the description of "Modular Structure of Module Information and Communication" (Wehling, 2007). The development of subject areas was essential to fulfil the accordant approaches in each case. Basing on crucial subject areas a suitable classification can be found. This classification again is fundamental for the design of lectures with i.e. a hierarchical structure. Once the contents of lectures were found and worked out thematically, concatenated lectures could be bound together to modules. These modules are part of accordant Main Modules which then can be put together for the basis of a new curriculum for technology education in the European Union.

Title of the Course: ELECTRICAL ENGINEERING										
Semester	Module	Teaching Methods (Student Workload)								Credit
		Lecture	Recite	Lab.	Project	Homework	Field study	Seminar	Total	
1	MM1	60		30		40		20	150	6
<b>Compulsory / Elective</b>		Compulsory								
<b>Prerequisites</b>		Basic knowledge in electronics Knowledge in a simple control system Basic knowledge in computer handling								
<b>Objectives</b>		-To introduce students to the epistemic characteristics of information technology -To provide a foundation for further study and employment in a range of contexts where this knowledge and understanding will be applied.								
<b>Learning Outcomes</b>		-The ability to classify and analyze the relationships among the concepts used in technology education as they apply to electronics technology, -Knowledge of generic information technology and specific to the fields in which the information technology is used.								
<b>Bibliographical References</b>		-“Communication systems”, Author: Marcelo S. Alencar, Springer, 2005. -“Microelectronic circuits” Authors: Adel S. Sedra, Kenneth C. Smith, Oxford University Press, 4th edition, 1997. -“Signals and systems” Authors: A. V. Oppenheim, A. S. Willsky, Prentice Hall, 2nd edition, 1996. -“Electrical Engineering”, Authors: Ralf Kories, Heinz Schmidt-Walter Springer, 2003								
<b>Assessment Criteria</b>									<i>If any, mark as (X)</i>	<b>Percent (%)</b>
		<b>Midterm Exams</b>								
		<b>Quizzes</b>								
		<b>Homework</b>								
		<b>Projects</b>								
		<b>Term Paper</b>								
		<b>Laboratory Work</b>							X	30
		<b>Other (please specify)</b>								
		<b>Committee Exam</b>								
		<b>Final Exam</b>							X	70
Course Content										
Week	Subjects									
1	Communications Basics: Digital and Analogue Signals									
2	Digital transmission of analogue signals									
3	Communication channels									
4	Analogue data									
5	Feedback principles: application to Operational Amplifiers									
6	ADC and DAC converters									
7	Digital Logic Elements									
8	Multi vibrators									
9										

**Figure 8: ECTS (European Credit Transfer System) form**

## 10. FURTHER ASPECTS

The main action lines of the Bologna process can be summarised as; the adoption of easily readable and comparable degrees (through learning outcomes), promotion of the mobility (recognition of the studies) and the establishment of a system of credits (through student workload). In a relatively short period, seven European countries have concentrated on these issues for providing a common curriculum for graduating technology teachers. The follow up

actions for the improvement and progress that can be as a part of other projects can be summarised as follows:

- Adopt the content and the learning outcomes to the National Qualifications Framework of the European countries consistently
- Adopt the results and the products to other European countries within the framework of “Transfer of Innovation” projects of the LdV.
- Design specific assessment methods to test the achievement of the learning outcomes and if necessary modify the module contents and assessments in the light of feedbacks.
- Provide interactive e-learning materials concerning the obtained modules within the framework of LdV and/or FP7 Programmes.

## REFERENCES

Theuerkauf, W. (2006). *Comment about the Interviews of Experts in the Project “Modular TE”*, Report of the National Evaluator. Technical University of Braunschweig. Technological Education and Information Technology. Germany.

Wehling, J. (2007). *Modular Structure of Module Information and Communication*. Valorisation Conference of the European project Modular TE, Ankara, Turkey.

ModularTE. (referenced: 27.10.2007). *Homepage of the European project Modular TE*, Webpage: <http://www.modularte.gazi.edu.tr> , New Approaches on Technology Education.

Kennedy, D. (2007). *Writing and Using Learning Outcomes*. University College Cork, Quality Promotion Unit, Ireland. ISBN: 978-0-9552229-6-2

Wehling, J. and Haupt, W. (2001). *Data structuring of online-based courses for technology education*, PATT-12 (Pupils' Attitude Towards Technology) conference for Optimal Use of Resources in Technology Education, Beute. Cape Town. South Africa.

Ropohl, G. (1999). *Allgemeine Technologie, Eine Systemtheorie der Technik*. Hanser. München. Germany. ISBN: 3-446-19606-4.

Richtlinien und Lehrpläne. (1999). *Technik, Sekundarstufe II, Gymnasium/Gesamtschule*. Heft 4726. Ministerium für Schule und Weiterbildung, Wissenschaft und Forschung des Landes Nordrhein-Westfalen. Ritterbach. Frechen. Germany. ISBN: 3-89314-629-6.