

**Technische und gewerbliche Schulen**  
**Technical and Vocational Schools and Colleges**

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**Lehrplan der Höheren Lehranstalt für Elektronik**  
**Curriculum of the Secondary College of Electronics**

(BGBl. II Nr. 302/1997)

**English edition - May 1998**

## **Höhere technische Lehranstalten mit Elektronik - Abteilungen/ Secondary Technical Colleges with Departments of Electronics**

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## CURRICULUM OF THE SECONDARY COLLEGE OF ELECTRONICS

Program Codes:

8370 ... 1<sup>st</sup> and 2<sup>nd</sup> Year

8371 ... 3<sup>rd</sup> to 5<sup>th</sup> Year, Telecommunications

8372 ... 3<sup>rd</sup> to 5<sup>th</sup> Year, Technical Computer Science

8373 ... 3<sup>rd</sup> to 5<sup>th</sup> Year, Biomedical Engineering

### I. SUBJECT TIME TABLE <sup>1)</sup>

(Total number of lessons and number of weekly lessons of the different subjects)

A. COMPULSORY SUBJECTS	Lessons per Week					Sum	Teaching Assignment Group
	1	2	Year 3	4	5		
1. Religious Instructions .....	2	2	2	2	2	10	(III)
2. German .....	3	2	2	2	2	11	(I)
3. English .....	2	2	2	3	2	11	(I)
4. History and Political Education .....	–	–	–	2	2	4	III
5. Physical Education.....	2	2	2	1	1	8	(IVa)
6. Geography and Economics .....	2	2	–	–	–	4	(III)
7. Economy and Law .....	–	–	–	3	2	5	III
8. Applied Mathematics .....	4	4	3	3	2	16	(I)
9. Applied Physics .....	2	2	2	–	–	6	(II)
10. Applied Chemistry and Ecology .....	3	2	–	–	–	5	II
11. Descriptive Geometry <sup>2)</sup> .....	2	–	–	–	–	2	(I)
12. Applied Computer Science .....	2	2	2	–	–	6	I
13. Fundamentals of Electrical Engineering <sup>3)</sup> .....	4	5	–	–	–	9	(I)
14. Electronics and Digital Engineering .....	–	3	3	3	3	12	I
15. Industrial Electronics .....	–	–	4	2	2	8	I
16. Manufacturing Engineering and Design <sup>4)</sup> .....	3	3	3	4	4	17	I
17. Quality Assurance and Product Management..	–	–	–	–	2	2	I
18. Laboratory.....	–	–	3	–	–	3	I
19. Workshop-Laboratory.....	–	–	4	–	–	4	III
20. Workshop.....	8	8	4	–	–	20	(Va)
Compulsory Subjects of School-Autonomous “Special Training Focuses“ in compliance with Section B.	–	–	3	14	15	32	
Total number of lessons per week...	39	39	39	39	39	195	

B. COMPULSORY SUBJECTS OF SCHOOL-AUTONOMOUS SPECIAL FOCUSES	Lessons per Week			Sum	Teaching Assignment Group
	3	Year 4	5		
<b>B.1 Telecommunications</b>					
1.1 Telecommunications <sup>5)</sup> .....	3	2	3	8	I
1.2 Radio Frequency Engineering .....	–	4	4	8	I
1.3 Laboratory .....	–	4	8	12	I
1.4 Workshop-Laboratory .....	–	4	–	4	III
Total number of weekly lessons B.1.....	3	14	15	32	
<b>B.2 Technical Computer Science</b>					
2.1 Telecommunications and Radio Frequency Engineering .....	3	2	3	8	I
2.2 Technical Computer Science <sup>6)</sup> .....	–	4	4	8	I
2.3 Laboratory .....	–	4	8	12	I
2.4 Workshop-Laboratory .....	–	4	–	4	III
Total number of weekly lessons B.2.....	3	14	15	32	

B. COMPULSORY SUBJECTS OF SCHOOL-AUTONOMOUS SPECIAL FOCUSES	Lessons per Week				Sum	Teaching Assignment Group
	3	Year		5		
		4				
<b>B.3 Biomedical Engineering</b>						
3.1 Telecommunications.....	3	–	–		3	I
3.2 Anatomy and Physiology.....	–	2	2		4	III
3.3 Image Generating Systems .....	–	2	2		4	I
3.4 Biomedical Engineering .....	–	2	3		5	I
3.5 Laboratory .....	–	4	8		12	I
3.6 Workshop-Laboratory .....	–	4	–		4	III
Total number of weekly lessons B.3.....	3	14	15		32	

**Mandatory Work-Placement:** Minimum of 8 weeks during vacation before 5<sup>th</sup> year

C. OPTIONAL SUBJECTS, NON-OBLIGATORY PRACTICE, TUTORIALS	Lessons per Week					Teaching Assignment Group
	1	2	Year		5	
			3	4		
<b>C.1 Optional Subjects</b>						
Second Modern Language <sup>7)</sup> .....	2	2	2	2	2	(I)
Communication and Presentation .....	2	2	2	2	2	III
<b>C.2 Non-Obligatory Practice</b>						
Physical Education .....	2	2	2	2	2	(IVa)
<b>C.3 Tutorials <sup>8)</sup></b>						
German						
English						
Applied Mathematics						
Relevant Theoretical Compulsory Subjects						

<sup>1)</sup> Within the framework of section III deviations from subject-table are permitted by school-autonomous provisions for curricula.

<sup>2)</sup> In combination with relevant practice of 1 weekly lesson in “Electronic Data Processing“.

<sup>3)</sup> In combination with practice of 2 weekly lessons in the 1<sup>st</sup> and 2<sup>nd</sup> years, respectively.

<sup>4)</sup> In combination with practice of 2 weekly lessons in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> years each, 3 weekly lessons in the 4<sup>th</sup> year and 4 weekly lessons in the 5<sup>th</sup> year.

<sup>5)</sup> In combination with relevant practice of 1 weekly lesson in “Electronic Data Processing“ in the 4<sup>th</sup> year.

<sup>6)</sup> In combination with relevant practice of 2 weekly lessons in “Electronic Data Processing“ in the 4<sup>th</sup> and 5<sup>th</sup> years each.

<sup>7)</sup> Name of the language has to mentioned in official papers.

<sup>8)</sup> Parallel to the respective compulsory subjects up to 8 lessons per semester; classification like corresponding compulsory subject.

## II. GENERAL EDUCATION OBJECTIVES

Within the framework of the Austrian school system Secondary Technical and Vocational Colleges are designed to provide students with both general education and vocational training, which

- will enable them to pursue a highly qualified occupation and carry on a business in trade and industry.
- grants university access.

In order to meet the needs and requirements of everyday and professional life and in order to be prepared for the challenge of an academic career the graduate of a Secondary Technical and Vocational College will be equipped with professional skills ( theoretical and practical knowledge of business-relevant and related topics), methodical competence (capability of gathering information, planning solutions to problems and selecting and applying suitable methods.), social consciousness (ability of co-operation, communication and working in teams) and individual creativity (capacity to organise his personal and professional life and his own personality actively, to show self-initiative and interest in further education ).

In accordance with this comprehensive conception of competence the graduate of a Secondary Technical and Vocational College will acquire the following qualifications:

- He will get a sound engineering knowledge up to date required for everyday and professional life and an academic career. He will know business-relevant legal regulations, standards and practices and be able to employ and operate commonly used devices.
- He will observe and evaluate routines, facts, processes and strategies and be able to describe them in correct German and in at least one foreign language, written and orally. He will also be able to represent them by symbols used in mathematics and information science. The graduate will further be able to gain information from the media, evaluate it critically and relate it to other ideas.
- He will gain an insight into processes of political and managerial economy and will be informed about business administration and law, which will enable him to pursue a trade, a craft or a career in industry. He will further be able to further develop and utilise his skills in business life.
- He will be provided with fundamentals of engineering and science, basic concepts of mathematics and science in order to be ready to deal with issues relevant to everyday life and ecology. Complementary to business training he will further develop general interdisciplinary skills.
- He will be prepared to participate in public and cultural life; he will declare himself to co- and self- determination in democracy and show responsibility in the presence of ecological and political changes by standing up for international understanding, professional ethos, a critical attitude towards consumption, environmental protection and a conduct of partnership and devote his life to these values. He will recognise the meaning of co-operation within the European Union and with other countries.
- He will support a concept of proficiency consistent with society and environment and preserve this proficiency and health by his own attitude towards the way of life, leisure culture and further education. He will be ready to apply these principles to his staff, and foster them by an open management style.

In the sense of general education schools have to face additional tasks which are summarised in teaching principles. Among them are: Health, media and sexual education, political awareness, an acceptance of the equality between men and women, concern for the environment, traffic concepts, a comprehensive national defence as well as an education concerning economy and consumption.

#### **Subject-Relevant Training Objectives:**

The Secondary College of Electronics provides basic mathematical and design concepts for understanding and dimensioning electronic components and circuits, relevant knowledge in manufacturing, application and business routines in special consideration of quality and project management. Starting from a solid basis in electrical engineering, electronics and manufacturing technology, the course provides knowledge in microelectronics (measurement technology, control engineering and sensorics), transmission engineering (audio-visual media, analogue and digital transformers), computer engineering (microprocessors and microcontrollers, hard and software design) and quality management. General business training is intensified by three school-autonomous special training foci:

- Special focus on "Telecommunication": This course gives the student competent knowledge of radio engineering, mobile radio and satellite technologies.
- Special focus on "Technical Computer Science": The syllabus stresses software engineering, computer aided engineering, computer networks and data transmission.
- Special focus on "Biomedical Engineering": The course emphasises computer aided image processing and electronic devices for diagnosis and therapy.

Graduates are trained to work in development, manufacture, sale, commissioning and maintenance of subject-relevant and related fields.

### **III. SCHOOL-AUTONOMOUS PROVISIONS FOR CURRICULA**

#### **IIIa. General Provisions**

School-autonomous provisions for curricula (School Organisation Law §6/1) grant schools independence in the organisation of subject-timetables and curricula-determined teaching-contents (syllabi of the different subjects) and in the choice of training and work forms as well as in the organisation of the training.

In order to make efficient use of these opportunities it is essential to be aware of the special needs and problems of the respective school or class at a certain location as well as the resulting ambitions and aims thereof. This independence requires the development of concepts which consider the needs of students, parents and teachers alike as well as the specific characteristics of the school.

School-autonomous provisions for curricula must not only observe the extent of teachers' weekly assignments provided but also institutional facilities such as rooms and equipment.

School-autonomous provisions for curricula have to consider training objectives concerning general education as well as occupation-oriented theoretical knowledge and practical skills. Within the framework of the Austrian school system they also have to provide students with the opportunity to transfer courses.

### **IIIb. School-Autonomous Deviations from Subject-Tables**

School-autonomous provisions for curricula allow schools to work out their own tables of compulsory subjects, which may deviate from the standard ones, provided the following provisions are considered:

1. It is permitted to change the distribution of the total number of compulsory weekly lessons and their respective contents over the years.
2. During the course the number of weekly compulsory subjects can be reduced by up to ten lessons a week, if - in return - additional compulsory subjects are introduced or the number of lessons of curricular compulsory subjects is increased to the same extent. This reduction is limited by the fact that compulsory subjects may only be reduced by one lesson a week. The reductions must not cause a complete loss of a compulsory subject in one year.
3. In each year a compulsory subject can be combined with another methodically and content related compulsory subject to one comprehensive compulsory subject. The new name must refer to the names of the two subjects which the new subject derives from.
4. Instead of the compulsory subject English another modern language can be taught.

If paragraphs 1. or 2. are applied, special consideration has to be given to the fact that the total number of weekly lessons of the course must be preserved and that there must not be more than 40 lessons per week in any year.

School-autonomous provisions for curricula may establish extra-curricular optional subjects, non-obligatory practice lessons and tutorials as well as change the number of lessons for corresponding programmes provided by the curriculum.

### **IIIc. School-Autonomous Provisions for Training Focuses**

If curricula include school-autonomous training focuses, these school-specific focuses have to be determined by school-autonomous provisions for curricula. Some focuses can be established as alternative compulsory subjects.

### **IIId. Provisions concerning Contents of Subjects and Classification of Subjects according to Teaching Assignment Groups**

- (1) If extra-curricular subjects are created or if subjects for which the curriculum provides no contents are established within the framework of school-autonomous provisions for curricula, school-autonomous provisions for curricula have to contain relevant directions. If school-autonomous provisions for subjects provide an increase in the number of lessons, additional training and teaching aims, descriptions of contents and didactic principles may be defined.
- (2) If additional subjects are created or existing subjects are changed subject-relevant training objectives of the curriculum and the following directions have to be observed.

#### **Directions for Training and Teaching Aims:**

The student will acquire general and subject-relevant competences which - under special consideration of regional requirements - emphasise and complete attitudes, knowledge and skills provided in other compulsory subjects.

#### **Directions for Contents:**

If contents include topics which cannot be covered by increasing the number of curricular lessons the following additional subjects have to be provided:

#### **“Foreign Language“:**

Another modern language whose organisation of contents and didactic principles is equivalent to those of the compulsory subject English. (Teaching assignment group I)

#### **“Personality Training“:**

Promotion of self-development by teaching offers concerned with general education, humanities and business practice. (For classification into teaching assignment groups see §7 of Teaching Assignment Law for federal teachers)

#### **“Economy and Technology“:**

Teaching programmes which emphasise economic training relevant to the specific technical field. (Teaching assignment group I for training areas management engineering, electronic data processing and organisation; otherwise teaching assignment group II)

“Law and Political Education“:

Teaching courses which stress political education and subjects concerning law with special regard to independent practice of trade. (Teaching assignment group III)

“Environment“:

Introduction to domains of general science in addition to technical-scientific education. (Teaching assignment group III)

“Special Theoretical Subject Training“:

Supplementary courses with non-encyclopaedic syllabi. (Teaching assignment group I)

“Projects“:

Teaching offers which aim at interdisciplinary strategies within the domain under special consideration of theoretical and practical laboratory assessments. (Teaching assignment group I)

“General Theoretical Subject Training“:

Introduction to engineering disciplines which are not focused on in the rest of the course. (Teaching assignment group II)

Directions for **Didactic Principles**:

Pedagogic concepts should foster the student’s ability to co-operate, his intellectual flexibility and his concern for his social, economic and ecological surroundings. Project teaching - even if involving students from different grades or block tuition- is recommended wherever possible.

## **DIDACTIC PRINCIPLES**

### **IIIe. Preparations of Contents**

In order to reach the general training objectives educational background of students have to be considered and the contents of the subjects have to be selected according to practical requirements of the subject field.

Sound knowledge of essential contents should be preferred to an overall outline. In order to foster motivation new topics have to be introduced with an orientation to practical problems. Cross- references within a subject and between subjects are essential for understanding the subject matter and for the development of interdisciplinary skills.

It is decisive for training success that subject matter is arranged clearly and according to the age of the students. Teaching - and understanding aids, especially those prepared by the teachers themselves, contribute to this success.

In order to provide the students with skills in due time and to avoid parallelisms teachers will have to work in teams. It is recommended to build up a network of related subjects in the form of co-ordinated content-distribution-plans.

As general education and training aims require training to be up to the state of the art, teachers are expected to improve their specific knowledge and skills continuously. The curriculum presents a directive framework for this purpose.

### **IIIf. Organisation of Lectures**

Working on projects in groups simulates practice in business situations and emphasises the students’ communicative competence. The student will profit by the fact that his fellow students encourage and criticise his way of solving problems and his self analysis, which is essential for training progress and future professional work forms.

Excursions, field practice, lectures of industrial experts and work placement grant an insight into relations between technology and business organisation as well as into social aspects of professional life.

All lectures listed in the subject-table can partly or completely be given in block tuition (1 lesson per week corresponds to 40 lectures a year).

Different themes of a subject can be taught by different teachers according to the teachers' skills and special knowledge; teachers should aim at good co-operation with respect to their common assessment of the students' proficiencies.

For pedagogic and organisational reasons different subjects can be combined to form concentrated training units. (School Time Law 1985, §4/2, Federal Law Gazette 77, as amended)

#### IV. SYLLABUS FOR RELIGIOUS KNOWLEDGE LESSONS

- a.) Roman Catholic Instructions  
See promulgation of Federal Law Gazette 30/1984
- b.) Protestant Instruction  
See promulgation of Federal Law Gazette 515/1991
- c.) Old Catholic Instructions  
are generally given in groups according to the Law of Religious Instructions §7 as amended. Consequently the syllabus for the upper level of Secondary Academic Schools is to be applied.
- d.) Islamic Instructions  
See promulgation of Federal Law Gazette 421/1983.
- e.) Israelite Instructions  
Promulgation of Federal Law Gazette 88/1985 as amended shall analogously be applied.
- f.) New Apostolic Church Instructions  
See promulgation of Federal Law Gazette 269/1986.
- g.) Instructions of The Church of Jesus Christ of the Latter Day Saints  
See promulgation of Federal Law Gazette 239/1988.
- h.) Syrian-Orthodox Instructions  
See promulgation of Federal Law Gazette 467/1988.
- i.) Greek-Orthodox Instructions  
See promulgation of Federal Law Gazette 441/1991.
- j.) Buddhist Instructions  
See promulgation of Federal Law Gazette 255/1992.

#### V. TRAINING AND TEACHING AIMS OF SUBJECTS; DISTRIBUTION OF CONTENTS OVER THE YEARS

##### A. COMPULSORY SUBJECTS

##### 2. GERMAN

##### **Training and Teaching Aims:**

The student will

- have command of the standard German language in speech and writing.
- be able to make efficient use of means providing information on pronunciation, orthography grammar and style and gather relevant information on cultural and professional affairs.
- be able to develop and master personal and professional communicative situations in speech and writing state and present facts adequately to addressee and situation and evaluate business-oriented texts independently and critically.
- comprehend the quality of literary works, be able to evaluate it and gain an insight into the contents of other art forms.
- understand the function of the media as institutions, economic factors as well as educational, entertainment and information facilities. Within the range of his activities he will further be capable of dealing with media consciously, critically and participatingly.



**Contents:****1<sup>st</sup> Year :****Correctness of Language:**

Practice-oriented application of orthography and punctuation. Spelling and meaning of frequently used foreign words, technical terms. Language structures (identification, application).

**Oral Communication:**

Presentation of facts (that have been experienced, heard, seen or read) in standard language. Phone calls, reports, discussions.

**Written Communication:**

Practice-oriented textforms (report, summary curriculum vitae, letter of application). Creative text forms.

**Literature, Art and Society:**

Topics from the student's experiences treated in literature and other art forms (themes, motifs, formal aspects, descriptions, explanations, evaluation of texts). Literary genres.

**Media:**

Mass media (kinds and functions); advertising and consumption; sources of information (reference books, institutions, use of libraries)

**2<sup>nd</sup> Year :****Oral and Written Communication:**

Presentation of facts and the course of events, characterisations, analysing, commentaries. Presentation, making appeals, petitions, excerpts, minutes. Basic concepts of communication. Free creative writing.

**Language Standards:**

Training and improvement, orthography, punctuation, vocabulary and language structures.

**Literature, Art and Society:**

Society relevant topics in literature and other art forms (themes, motifs, formal aspects, description, explanation, evaluation of texts)

**Media:**

Styles in journalism and advertising.

**3<sup>rd</sup> Year :****Written and Oral Communication:**

Argumentation, commentaries, subject-relevant reports, technical texts, statements, interviews, conversation and discussion techniques. Communication techniques. Creative writing.

**Language Standards:**

Training and improvement. Orthography, punctuation, vocabulary and language structures.

**Literature, Art and Society:**

History of civilisation up to the beginning of the 19<sup>th</sup> century (époques in the light of intellectual history). Text commentaries and evaluations.

**Media:**

Creative criteria and means of manipulation of mass media.

**4<sup>th</sup> Year :****Oral and Written Communication:**

Speech and lecture. Analysing and comments. Written reports. Creative writing.

**Language Standards:**

Training and improvement. Orthography, punctuation, vocabulary and language structure.

**Literature, Art and Society:**

History of civilisation of the 19<sup>th</sup> century (époques in the light of intellectual history); evaluation of texts. Relations to other art forms.

**5<sup>th</sup> Year :****Oral and Written Communication:**

Job interview, letters of application, negotiations, debates, analysis and evaluation. Written report. Presentation techniques. Free writing.

**Language Standards:**

Training and improvement. Orthography, punctuation, vocabulary and language structures.

**Literature, Art and Society:**

History of civilisation of the 20<sup>th</sup> century (époques in the light of intellectual history); evaluation of texts. Commentaries on cultural works and contemporary developments.

**Media:**

Evaluation of media contents, analysis of effects.

In each year two to four written tests, which may require one or more lessons.

**3. ENGLISH****Training and Teaching Aims:**

The student will

- be able to master general and business-relevant communicative situations in the foreign language by showing skills in listening and reading comprehension and speech and writing; emphasis is laid on communicative skills and understanding.
- will be able to transfer information precisely from his mother tongue into the target language and vice versa and comment on it.
- will be able to deal with practical business events in speech and writing under special consideration of commonly used communication forms; he will also be able to join business-relevant group activities with English as a working language.
- will be able to employ technical tools for communication and information suitable for the specific situation and make use of modern presentation and moderation techniques.

**Contents:****1<sup>st</sup> Year :****General Communication Topics:**

Integration of previous experiences in communication; topics adequate to the student's knowledge, skills and interests.

**Business-Relevant Communication Topics:**

Elementary technical facts of the subject discipline; basic scientific and mathematical concepts.

**Vocabulary and Language Structures:**

Integration of previously acquired skills. Repetition and supplementation of grammatical skills and vocabulary required for idiomatic expression in the fields of relevant communication topics.

**2<sup>nd</sup> Year :****General Communication Topics:**

Themes taken from the student's social surroundings. Current issues.

**Practice-Relevant Communication Topics:**

Applications of scientific and basic technical subjects.

**Vocabulary and Language Structures:**

Extension of vocabulary and language structures required for expressing facts of relevant communicative themes.

**3<sup>rd</sup> Year :****General Communication Topics:**

Topics with special focus on Austria; current issues.

**Practice-Relevant Communication Topics:**

Products and processes of the subject area.

**Vocabulary and Language Structures:**

Training and improvement of vocabulary and language structure required for expressing facts of relevant communicative themes.

**4<sup>th</sup> Year :****General Communication Topics:**

Topics related to countries of the English speaking world and the European Community; current issues.

**Business-Relevant Communication Topics:**

Topics relevant to business administration and management engineering.

**Vocabulary and Language Structures:**

Complex contents of grammar and vocabulary.

**5<sup>th</sup> Year :****General Communication Topics:**

Topics of international relevance; current issues.

**Business-Relevant Communication Topics:**

Complex themes of business practice; business management and business organisation.

**Vocabulary and Language Structures:**

Applications of acquired structures and vocabulary; summarising survey.

In each year two to four written tests, which may require one or two lessons.

#### 4. HISTORY AND POLITICAL EDUCATION

**Training and Teaching Aims:**

The student will

- be provided with historical knowledge relevant to everyday and business life under special consideration of Austrian history and he will be able to make use of this in his political and social activities.
- be able to gather and evaluate information required for an understanding of the contemporary situation of the world and the interactions of politics, economy and culture.
- be able to analyse and assess contemporary political, social, economic and cultural situations and processes relying on historical models.
- know the historical development of the branch of trade he has been trained for and relate it to the general historical development as well as affirm the preservation of cultural heritage.
- be prepared to participate actively in public and cultural life and show political and social responsibility; he will affirm the principles of the Austrian federal constitution and he will also be ready to meet different cultures and settle conflicts peacefully.
- be informed about development tendencies of the contemporary society.
- be conscious of environment and critical of consumption.

**Contents:****4<sup>th</sup> Year :****Classical Antiquity:**

Cultural and scientific heritage (democratic tendencies, religious heritage).

**Middle Ages:**

Culture and society in feudalism; development in Austria (formation of Austrian lands); from the theocentric to an anthropocentric view of the world.

**Early Modern Times:**

Inventions and discoveries; economy (from feudalism to early capitalism); culture, society and science (Renaissance, humanism, reformation; foundation of modern territorial states); developments in Austria.

**Age of Reason and the Civil Revolution:**

Basic spiritual concepts, state theories, revolution and Restoration, foundation of the United States; Napoleon and Europe; nationalism and liberalism; (human rights, separation of powers, development of parliamentarism); Industrial Revolution and social issues; society, economy, culture, science and technology. Development in Austria.

Age of Imperialism:

National unification endeavours; Europeanising of the world; Europe before the First World War; First World War; society (haute bourgeoisie, industrial society, women's liberation); ideologies and political movements (mass parties, right to vote); economy, science (evolution), technology, culture; development in Austria.

5<sup>th</sup> Year :

Tendencies and Developments in the 20<sup>th</sup> Century - the Period before 1945:

Russian revolution. Reorganisation of Europe; totalitarian ideologies and systems (politics, persecution, resistance); crises of democracies; League of Nations; non-European developments; Second World War; society, economy, culture (inflation, world depression, governmental control, science, technology); development in Austria ( domestic and foreign policy of the First Republic, time of national socialism).

Tendencies and Developments in the 20<sup>th</sup> Century - the Period after 1945:

United Nations and international organisations; east-west-conflict (formation of blocks, political centres of conflict), unification of Europe (EEC, Council of Europe, European Community, European Economic Area, EU); de-colonisation and movement of the non-aligned countries; north-south-conflict; racism, alternative movements, terrorism, social conflicts; peace initiatives; society, culture, economy (economic growth and ecology, science, technology); developments in Austria (domestic and foreign policy of the Second Republic, neutrality, social partnership between employers and employed)

Contemporary Social and Political Developments:

Changes and conflicts in Eastern and Southern Europe. Nationalism. Migration and multicultural society. Political dimension of European integration.

Basic Concepts of Politics:

Democracy (direct and indirect democracy; parliamentarism). Formation of political will in democracy (elections, parties, representations of interest). Areas of the Austrian political system. International politics. Basic constitutional rights, rights of freedom and human rights.

## 5. PHYSICAL EDUCATION

See Federal Law Gazette 37/1989.

## 6. GEOGRAPHY WITH ECONOMICS

### Training and Teaching Aims:

The student will

- be provided with regional and global topographic knowledge relevant to business and leisure time.
- be able to gather, evaluate and present information necessary for the investigation and assessment of living spaces.
- display a knowledge in economic geography.
- be able to explain geofactors and comment on their networking in ecological and economic systems.
- be informed about the limitations of the earth's resources and be able to explain the conflicts caused by their exploitation and distribution.
- be able to analyse individual and social demands for geographic space and recognise social aspects.
- understand the meaning of regional development and area development planning for securing quality of life.
- be ready to participate responsibly in the arrangement and preservation of living space.

### Contents:

1<sup>st</sup> Year :

Landscape and Human Ecology:

Ecological structure of economy concerning geofactors; regional belts of the earth; interaction between ecosystems and working human beings.

Population:

Representation of processes concerning population; demographic structures and processes; limits of capacities.

Social and Economic Orders:

International economy; global interactions; alliances (EU and non-European alliances).

2<sup>nd</sup> Year:

Developing Countries:

Features; problems, development theories and strategies.

Industrial countries:

Sectoral change; urbanisation; economic regions; regional development and area development planning.

## 7. ECONOMY AND LAW

### **Training and Teaching Aims:**

The student will

- be aware of the meaning of managerial economic considerations and concepts of political economy for the subject area.
- know legal regulations relevant to business administration and apprenticeship training.
- know the fundamentals of business accounting and contracting.
- know civic and constitutional principles and attitudes and be able to practise them.

### **Contents:**

4<sup>th</sup> Year:

Political Economics:

Economic systems, Austrian economic order; production factors; market and price; money and currency; economic situation and growth; budget policy; income and consumption; foreign trade and balance of payment; international economy, European integration, bilateral economic relations, development aid.

Accounting:

Fundamentals of double entry book-keeping, internal index figures.

Law:

Outline of essential legal sectors. Fundamental concepts of the Civil Code with special focus on contracting business; payment transactions, cheque and exchange law. Basic concepts of trade law, environment law and European law.

Labour Legislation and Social Law:

Basic concepts of labour legislation and social insurance law. Fundamentals of personnel accounting. Legal, pedagogic and psychological basics of apprenticeship training.

5<sup>th</sup> Year:

Accounting:

Fundamentals of cost accounting (full and variable costing) in trade and industry. Controlling.

Management and Entrepreneurial Law:

Basics of planning and control, organisation; sale, supply, logistics, in-plant training and further education. Financing. Commercial law, insurances against possible risks, insolvency law, tax law.

Austrian Legal System and Federal Constitution:

Basic concepts of federal constitution ( democratic, republican, constitutional state and federal principles, separation of powers). Parliament, federal government, federal president. Legislative of confederation and federal counties, administration (organisations, autonomous corporations), judicature (instances, legal proceedings), checks of public authority, (parliamentarian checks, supreme courts, people's advocate, court of audit), written and practised constitution.

## 8. APPLIED MATHEMATICS

### **Training and Teaching Aims:**

The student will

- know the mathematical terminology, theories and methods relevant to practice and further academic studies and will be able to apply them.
- be able to analyse basic facts and proceedings of nature, technology and economy and describe them by mathematical models, find model solutions and evaluate them.

- be able to employ mathematics as a tool for gaining information and for communication in business, engineering and science.
- be able to present mathematical concepts and demonstrate algorithms.
- be able to employ modern aids efficiently.

**Contents:**

**1<sup>st</sup> Year :**

**Algebra:**

Number systems; operations with variables and terms; vectors (representation, magnitude, addition, subtraction, multiplication by a scalar); linear equations and inequalities; solving of formulas, systems of linear equations.

**Numerical Computations:**

Representation of numbers; errors of representation; estimation of results.

**Functions:**

Concepts, representation in co-ordinate systems; linear function; evaluation of tables, interpolation; direct and inverse proportionalities.

**Geometry:**

Plane geometry ( similarities; triangle, rectangle, circle; Pythagorean Theorems); stereometry; trigonometry of right triangles.

**2<sup>nd</sup> Year :**

**Algebra and Geometry:**

Vectors (dot product, orthogonality, vector product). Quadratic equations; exponential equations. Complex numbers (representation, operations). Trigonometry of the oblique triangle.

**Functions:**

Properties; inverse functions; quadratic functions, power and radical functions, exponential and logarithmic functions; general sine function, addition theorems, evaluation of functional graphs and functional equations; parametric representation.

**Business Mathematics:**

Compound interest calculations, linear optimisation.

**Theory of Probability and Statistics:**

Frequency distributions; characteristics; probability (addition and multiplication rules).

**3<sup>rd</sup> Year :**

**Calculus:**

Difference equations. Sequences, limits, continuity. Differentiation (difference and differential quotient, rules for differentiation, applications); integration (definite and indefinite integral, integration of elementary functions, applications). Functions of two variables, partial derivatives.

**Numerical Mathematics:**

Error approximation and propagation; problems of conditioning; numerical methods for the solution of equations and for the evaluation of definite integrals; interpolation.

**Linear Algebra and Analytic Geometry:**

Matrices (operations and applications), determinants. Straight lines and planes; conic sections in central position. Algebraic structures.

**5<sup>th</sup> Year :**

**Theory of Probability and Statistics:**

Discrete and continuous distributions, inductive statistics (estimation of parameters, significance tests), correlation analyses (correlation, regression), statistical methods of quality management. Applications.

Current issues of applied mathematics with special focus on the subject discipline.

**1<sup>st</sup> to 5<sup>th</sup> Years :**

Specific applications of the discipline; use of practice-relevant calculation aids, computer aided assignments.

Four written tests in years with four respectively three weekly lessons; otherwise two.

## 9. APPLIED PHYSICS

### **Training and Teaching Aims.**

The student will

- watch and describe processes in nature and relate them to special branches of physics.
- understand and apply physical methods and relate them to physical-technological assignments using (simple) mathematical symbols.
- be able to describe connections in words, in symbolic language and scientific terminology as well as graphically and in tables and formulas.
- be able to estimate dimensions and assess the plausibility of results.
- know and be able to apply the physical laws which are relevant to the production and application of materials, devices, machines, plants and processes commonly used in business practice. He will display a sound knowledge of technologies applied in energy utilisation and will be able to describe their effects on environment.
- know the modes of thinking and working of classical modern physics; he will be aware of the nature of conceptions of physical models and their limitations; he will further be able to comment critically on current scientific issues.

### **Contents:**

1<sup>st</sup> Year :

General Physics:

Meaning and methods of physics; international units (SI- system)

Kinematics and Dynamics:

Velocity, acceleration, composite motions. Newton's laws, force, work, energy, power, efficiency, momentum, conservation theorems of mechanics; rotation, central forces, gravitation.

Aeromechanics and Hydromechanics:

Pressure, buoyancy, flows. Molecular forces.

2<sup>nd</sup> Year :

Electricity and Magnetism:

Electric and magnetic field; mechanisms of conduction; magnetic characteristics; induction; electric circuits, energy supply.

Oscillations and Waves:

Oscillations and waves in mechanics, optics and electromagnetism.; resonance; wave propagation, standing waves, interferences, diffraction and scattering; modulation; acoustics.

Optics:

Reflection, refraction, total reflection, light velocity, imaging by optic systems. Diffraction at gap and grid, capacity of resolution of optic devices, interferences of thin layers, polarisation, photo elasticity, scattering.

Radiation:

Light and colours, spectra, emission and absorption of radiation; use of solar energy; laser; photometry, laws of temperature radiation.

3<sup>rd</sup> Year :

Thermodynamics:

Temperature; heat energy, heat transfer, thermal insulation; state equations of ideal gases (states of aggregation, temperature-concentration diagram); theorems of heat theory, gas kinetics, diffusion.

Fundamentals of Quantum Mechanics:

Wave-part-dualism, quantisation of energy, uncertainty principle, material waves.

Fundamentals of the Theory of Relativity:

Constancy of light velocity, equivalency of mass and energy, space-time-continuum, experiments in thought.

Atomic and Nuclear Physics:

Structure of atoms and nuclei, radioactivity; fission, nuclear fusion, effects of radioactive radiation, radiation protection, applications of radioactive isotopes.

Energy Utilisation:

Technologies for energy utilisation and conversion; energy supply; entropy and ecological balance; energy budget of the earth.

## 10. APPLIED CHEMISTRY AND ECOLOGY

### Training and Teaching Aims:

The student will

- observe and describe proceedings as well as phenomena of nature and technology and relate them to special branches of chemistry.
- know the concepts and methods applied in chemistry.
- be able to comment on current scientific issues.
- know the laws and methods of chemistry relevant to personal life and business practice and estimate dimensions; he will also display a knowledge in relevant chemical production and disposal technologies.
- show responsibility in the exploitation of materials by considering ecological and health factors.
- realise the opportunities and limitations of technological, economic and ecological assessments of products.
- recognise the meaning of soil, air, water and natural cycles as well as their changes caused by anthropogenous influences.
- know how to gain further information.

### Contents:

1<sup>st</sup> Year :

Structures of Matter:

Pure substances, mixtures, elements, compounds, atomic models, nuclides, radioactivity, periodic system, chemical compounds, formula representation and nomenclature.

Chemical Reactions:

Reaction equations, energy budget, chemical balances, catalysis, stoichiometry.

Types of Reactions:

Electrochemical series, Galvanic elements, electrolysis, corrosion, protection against corrosion.

Inorganic Basic Materials:

Production, use, cycles and residual utilisation.

Ecology:

Ecosphere and ecosystems (air, water, soil), cycles, balances, pollution, environmental protection.

2<sup>nd</sup> Year :

Carbon:

Bond types, modification, inorganic carbon compounds, (oxides, carbon acid), hydrocarbon, petroleum chemistry (petroleum, recovery, refining, products), hydrocarbon derivatives containing halogen, oxygen or nitrogen; macromolecules (natural substances and plastic materials), production, applications, residual utilisation.

Silicon:

Pure silicon, silicic acid, natural and technical silicates, organic silicon compounds, production, applications, residual utilisation, building materials.

Ecology:

Influence on ecosphere, (air, water, soil) in the surroundings of carbon and silicon processing plants, environmental analytics and measures of environmental protection in special examples.

## 11. DESCRIPTIVE GEOMETRY

### Training and Teaching Aims:

The student will

- be able to identify the structure of an object represented in different views, evaluate the information of the drawing and make use of it in his design. He will also be able to sketch three-dimensional layouts by hand. He will further be



able to identify geometrical forms of technical objects according to the requirements of the subject discipline and put them down in a construction drawing.

- be able to split construction processes into smaller units by using adequate models and develop algorithms for solution.
- be familiar with the generation of subject-relevant curves, area and solids and the laws governing them.
- be able to represent three-dimensional layouts in 3D on CAD-systems employing the standard software available at school.

**Contents:**

1<sup>st</sup> Year :

Three dimensional co-ordinate system.

Methods of projection.

Projection of geometrical and technical solids as well as axonometry for practice in recognising an object from different views.

Design in Related Orthogonal Projection:

Line segments and lines, plane figures and planes in central, projecting and general position; length of a line segment, size and shape of a plane figure; projection of a line and an area; orthogonal position of lines and area; intersections of objects with plane surfaces; circle in central, projecting and general position.

Orthogonal axonometry of objects with plane surfaces.

3D-Designs by means of CAD:

Fundamentals of areas of revolution; intersections planes and areas of revolution; penetration.

## 12. APPLIED COMPUTER SCIENCE

**Training and Teaching Aims:**

The student will

- know the set-up, functioning and range of applications of electronic processing systems and know how to operate them.
- analyse complex problems and prepare them for programming.
- select and employ standard software for the solution to business problems.
- will be able to solve basic practical problems by means of higher level programming languages.
- be able to retrieve and transfer information electronically.
- be aware of the effects of electronic information processing on staff, business culture, environment and society.
- observe relevant regulations and standards.

**Contents:**

1<sup>st</sup> Year :

Fundamentals of Information Processing:

Configuration, function, interaction of the components, operation of standard operating systems.

Standard Software:

Practical applications, programming of macros.

Programming:

Problem analysis, basic concepts of programming in a higher-level language, design techniques, documentation.

2<sup>nd</sup> Year :

Alternative operating systems; standard software for school and business practice.

Programming:

Application of algorithms to basic problems, transformation into programs, programming of standard software packages; design of programs using standard development tools. Documentation.

3<sup>rd</sup> Year :

Program Design:

Methods of software design, data structures.

Telecommunication Engineering:  
Networks, information retrieval.

Process Control:  
Control of basic processes using standard interfaces.

Standard Software:  
Software for graphics and presentation, application of data bases, interaction of software packages.

Computer Science and Society:  
Effects of computer science on staff, business, culture, environment, and society. Data protection.

### 13. FUNDAMENTALS OF ELECTRICAL ENGINEERING

#### **Training and teaching aims:**

The student will

- have a sound knowledge of the laws of electrical engineering.
- be able to solve problems of electrical engineering independently.
- be able to prepare and perform fundamental measurement problems.
- will observe relevant regulations and standards.

#### **Contents:**

1<sup>st</sup> Year :

Terminology:

Quantities, units and equations with unspecified units.

Electric Circuits:

Electric Charge, resistance, Ohm's Law, Kirchhoff's Laws, resistance circuits; voltage and current sources, equivalent circuits, conductivity of semi-conductors, electrolytes and gases; work, power, efficiency and adaptation.

Electric Field:

Quantities and laws, energy and forces.

Magnetic Field:

Quantities and laws, energy and forces.

DC Instrumentation and Measurement:

Measurement of current, voltage and power. Errors of measuring.

2<sup>nd</sup> Year :

Conversion of Energy:

Electric heat, thermoelectricity, electrochemical voltage sources.

Time Dependent Electric Quantities:

Time dependent electric fields, time dependent magnetic fields; time response of electric components.

Sinusoidal Quantities:

Analytic and graphic representation, mean values, a.c. resistors, a.c. power, application of complex operations, resonance, locus diagrams, time charts and phasor diagrams, Bode-diagram; frequency response of simple two-terminal networks, transfer functions.

### 14. ELECTRONICS AND DIGITAL ENGINEERING

#### **Training and Teaching Aims:**

The student will

- know the characteristics of components used in electronics and digital technology.
- be able to design and dimension electronic circuits.
- plan and perform subject-relevant measurements.
- observe relevant regulations and standards.

**Contents:**2<sup>nd</sup> Year :

## Digital Engineering:

Analogue and digital representation, number systems and coding, basic logic operations, design methods, fundamentals of sequential logic, time response.

## Passive Components:

Properties, characteristic curves and quantities.

## Semiconductor Components:

Conduction mechanism, layout, function, characteristic quantities and curves, equivalent circuits, simple applications.

## Operational Amplifiers:

basic circuits.

## Optoelectronic Devices:

Layout, function, characteristic quantities and curves and basic applications.

3<sup>rd</sup> Year :

## Active Devices:

Layout, function, characteristic quantities and curves, equivalent circuits.

## Basic Electronic Circuits:

Amplifiers, oscillators, electronic switches. Stabilisation of voltages and currents; dimensioning.

## Logic Families:

Design, properties, characteristic quantities, applications.

## Electronic Transducers:

Analogue -digital-, digital- analogue-converter.

4<sup>th</sup> Year :

## Sequential Circuits:

Timing Diagrams, input forms, programmable logic devices.

## Microcontrollers:

Structures, programming, time response. Digital measuring techniques.

## Peripheral Components:

Storage devices and standard peripheral components, range of application; hardware and software design.

5<sup>th</sup> Year :

## System Design:

Components and systems specific for applications. Hardware description languages, computer architectures; interface techniques, test strategies.

## 15. INDUSTRIAL ELECTRONICS

**Training and Teaching Aims:**

The student will

- be able to operate commonly used electric and electronic measuring instruments and be familiar with standard procedures of measurement technology.
- be able to select devices and methods for the solution of practical business problems considering a reasonable relation between measuring accuracy and effort.
- be able to solve problems in the field of control engineering electronically.
- be provided with a sound knowledge of the construction and performance of electric machines, devices and installations, commonly used in this area, and will understand relevant concepts of power electronics.
- observe relevant regulations and standards.

**Contents:****3<sup>rd</sup> Year :**

Fundamentals of Industrial Measurement Technology:  
Measurement of electric and non-electric quantities.

Electrical Power Engineering:  
Conventional and alternative energy generation.

Open-Loop Control Engineering:  
Motors and actuators, stored programm control.

Electrical drives:  
Components, characteristic quantities, basic circuits.

**4<sup>th</sup> Year :**

Drive System Engineering:  
Processes and circuitry in power electronics systems.

Analogue and Digital Closed-Loop Control Engineering:  
Fundamentals, optimization, simulation.

**5<sup>th</sup> Year :**

Instrumentation, Control and Process Engineering:  
Industrial processes, industrial bus systems and computer-controlled measuring systems, applications in industrial plants.

## 16. MANUFACTURING TECHNOLOGY AND DESIGN

**Training and Teaching Aims:**

The student will

- know the characteristics, utilisation and treatment of materials and processing aids used in electronics as well as the relevant manufacturing methods.
- be able to demission electronic assembly groups and devices independently and design them by means of CAD.
- be capable of providing relevant production documents and software according to the state of the art.
- be able to operate and employ practical design aids.
- be able to prepare and perform subject-oriented measurement assignments.
- observe relevant regulations and standards.

**Contents:****1<sup>st</sup> Year :**

Materials Used in Electronics:  
Conducting and insulating materials.

Manufacturing Methods in Electronics:  
Precision engineering relevant to electronics, printed circuit board technology, SMD- technology.

Production Documents:  
Technical sketches, computer-aided presentation of objects complying with standards.

**2<sup>nd</sup> Year :**

Electronic Components:  
Types and dimensioning of components, basic circuits; dimensioning and simulation of simple circuits.

Production Documents:  
Computer-aided design of given objects.

**3<sup>rd</sup> Year :**

Electronic Assembly Groups:  
Function analysis, dimensioning with regard to defined efficiency features, simulation.

Electromechanical Components:

Criteria for selection and employment, mechanic functions.

Production Documents:

Design by means of CAD.

Product-Recycling:

Reprocessing, disposal.

4<sup>th</sup> Year :

Product development

Systematics and valuation; joint projects with the compulsory subjects “Laboratory“ and “Workshop-Laboratory“; development of devices and software, documentation and presentation.

5<sup>th</sup> Year :

System Development:

Joint projects with “Laboratory“ and economic subjects; project management and economic project supervision. documentation and presentation.

## 17. QUALITY ASSURANCE AND PRODUCT MANAGEMENT

### **Training and Teaching Aims:**

The student will

- get to know the routines, organisational measurements and quality objectives of quality management; he will further learn how to document and evaluate quality related processes and procedures and consider their efficiency.
- be introduced to total-quality-management ideas as a management strategy.
- get acquainted with methods for the analysis, planning, performing and supervision of marketing programmes as well as for the implementation of marketing concepts.
- make use of relevant regulations and standards.

### **Contents:**

5<sup>th</sup> Year :

Quality Assurance:

Quality, reliability and durability; total quality management.

Quality Management Systems in the Business:

Quality documentations and records, certification; project management.

Product Management:

Product planning and development.

## 18. LABORATORY

### **Training and Teaching Aims:**

The student will

- be able to design, perform, document and evaluate switching, testing, measurement and control problems of laboratory practice interdisciplinarily and independently.
- be able to select and employ suitable methods and devices considering both safety requirements and the costs.
- write research reports, evaluate them and comment on the results.
- be capable of implementing and testing microelectronic systems and designing the relevant software.
- be guided towards independence and team-orientation.
- observe relevant regulations and standards.

### **Contents:**

3<sup>rd</sup> Year :

Practical training in major areas of the compulsory subjects “ Fundamentals of Electrical Engineering“, “Electronics and Digital Engineering“, and “Industrial Electronics“.

## 19. WORKSHOP-LABORATORY

**Training and Teaching Aims:**

The student will

- solve and document practical production and operating problems in the areas of testing, measuring and installation, which exceed the limits of workshop training.
- be capable of finding engineering and economic solutions for job orders under special consideration of quality management.

**Contents:**

3<sup>rd</sup> Year:

Electronics:

Layout, testing and installation of digital and analogue assembly groups and devices of electronics.

Computer Engineering:

Upgrading, configuration, and repair of computer components.

Automation:

Free open-loop control systems; programming, operation and maintenance of numerically controlled manufacturing plants; CAD-CAM-CNC.

Telecommunications:

Measurement and test routines for analogue and digital transmission paths.

## 20. WORKSHOP

**Training and Teaching Aims:**

The student will

- improve his specific practical skills by designing, manufacturing and styling products usual in the branch of business
- be able to operate relevant tools, devices and facilities and consider economic aspects.
- be capable of analysing working processes and labour results in precise technical terminology.
- observe relevant safety rules.

**Contents:**

1<sup>st</sup> Year:

Workshop practice, workshop rules, general prevention of accidents (affecting all groups)

Basic Training in Electrical Engineering and Electronics:

Introduction and practical operation of measurement devices for measuring basic quantities of electrical engineering.

Visual recognition, soldering and de-soldering of electronic components.

Basic Training in Mechanics:

Manual and mechanic treatment of materials commonly used in electronics. Introduction to components used in precision engineering.

Electro-Installation:

Set-up, putting in operation and performance test of electro-installations. Measurements of electric consumers. Safety of electric installations.

Electronics.

Set-up, putting into operation and performance test of simple electronic circuits and devices. Operation of relevant measuring instruments.

Electromechanics:

Basic skills in the treatment of materials used in electronics. Assembly and maintenance of precision engineering components of electronics.

Plastic Engineering:

Manual treatment and machining of semi-finished plastic materials. Cast resin and adhesive technologies. Surface treatment.

2<sup>nd</sup> Year:

**Electro-Installations.**

Low-voltage installation technology and electric precaution measures. Layout of simple controls.

**Electromechanics:**

Manufacturing and assembly of mechanical component groups and case systems. Functionanalysis and repair of precision engineering components of electronics.

**Printed Circuit Boards Technology:**

Manufacture and test of printed circuit boards; CAD-CAM-CNC. Front panel manufacturing, plastic processing.

**Construction of Devices:**

Production of low and high frequency transmitters, transformers and coils. Manufacture of small devices.

**Electronics.**

Set-up and test of simple digital and analogue circuits. Components, connection techniques and assembly of computers.

**3<sup>rd</sup> Year :****Telecommunications:**

Layout, Configuration Programming, implementation and maintenance of communication systems. Antenna and transmission techniques.

**Electronics:**

Manufacture and putting in operation of digital and analogue assembly groups, fault analysis and repair of devices of entertainment electronics and electro-acoustics.

**Computer Engineering:**

Assembly, maintenance and networking of computer systems and peripheral devices.

**Production preparation:**

Job orders, production planning and production control. Development of production documents by CAD.

B. COMPULSORY SUBJECTS OF SCHOOL-  
AUTONOMOUS SPECIAL TRAINING FOCUSES

**B.1 TELECOMMUNICATIONS**

1.1 TELECOMMUNICATIONS

**Training and Teaching Aims:**

The student will

- be able to analyse circuits in telecommunications and assess frequency and time responses.
- be familiar with methods used in telecommunication engineering.
- be able to plan and solve subject-relevant measuring problems.
- observe relevant regulations and standards.

**Contents:**

3<sup>rd</sup> Year :

Linear Two-Pole Networks:

Characteristics, applications.

Linear Four-Pole Networks:

Characteristics, logarithmic scales, matching, level measurement.

Transmitters:

Frequency and pulse response.

Analogue Filters:

Frequency and time range, pole/zero point analysis, computer-aided filter design.

Sound-Converters:

Microphone, loudspeaker, measurement technology.

Signals and systems:

Linear and non-linear systems; time and frequency range, time-continuous and time-discrete signal analysis.

4<sup>th</sup> Year :

Lines:

Harmonic excitation, pulse response, optic signal transmission; measurement technology.

Digital Signal Processing:

Basic concepts, digital filters, computer-aided design.

5<sup>th</sup> Year :

Information Theory:

Basic concepts, signal coding.

Switched Networks:

Architectures, mobile communication, intelligent networks, protocols.

Digital Signal Processing:

Applications, hardware and software.

1.2 RADIO FREQUENCY ENGINEERING

**Training and Teaching Aims:**

The student will

- know construction elements and components of highfrequency engineering and will be able to dimension basic circuits;
- be able to solve problems concerning projects of highfrequency engineering systems.
- be familiar with commonly used transmission and recording techniques.
- be capable of planning and performing subject-relevant measuring assignments.



- observe relevant regulations and standards.

**Contents:**

4<sup>th</sup> Year:

Elements of Highfrequency Engineering:

Equivalent circuit diagrams, Smith-Diagram, S- and Y-parameters, measurement technology and computer-aided simulation.

Highfrequency Amplifiers:

Broad band, tuned and power amplifiers, matching.

Waveform Generation:

Oscillators, PLL; synthesisers, function generators.

Frequency Conversion:

Mixing, analogue and digital modulation.

Noise:

Fundamentals, measurement technology.

5<sup>th</sup> Year:

Radio Engineering:

Transmission and receiving systems, aerials and wave propagation, RF-measurement.

Electromagnetic Compatibility:

Fundamentals, measurement technology, interference suppression.

Microwave Technology:

Wave guide and strip line technology, satellite radio, measurement technology.

Audio-Visual Electronic Media:

Analogue and digital audio technology, analogue and digital image processing.

### 1.3 LABORATORY

Continuation of compulsory subject "Laboratory" of section A.

**Contents:**

4<sup>th</sup> and 5<sup>th</sup> Years:

Practical training in major areas of compulsory subjects "Fundamentals of Electrical Engineering", "Electronics and Digital Technology", "Industrial Electronics", "Telecommunication Engineering" and "High Frequency Engineering".

Joint projects with "Manufacturing Technology and Design" and commercial subjects.

### 1.4 WORKSHOP-LABORATORY

Continuation of compulsory subject "Workshop-Laboratory" of section A.

4<sup>th</sup> Year:

Digital Engineering:

Layout, implementation, repairing and testing of microprocessor controlled assembly groups and devices. Data technology.

Low- and Highfrequency Engineering:

Layout, installation, repair, and tests of analogue and digital assembly groups and devices. Electromagnetic compatibility.

Automation:

Architecture, implementation, and test of control systems. Design of basic programs.

Communications:

Digital switching engineering, PCM links, devices of mobile communication.

Production Preparation:

Analysis of work routines, rate settings, test and manufacturing devices, ergonomic aspects of work places. Monitoring and checking of time limits and test devices provided by quality management.

## B.2 TECHNICAL COMPUTER SCIENCE

### 2.1 TELECOMMUNICATIONS AND RADIO FREQUENCY ENGINEERING

#### Training and Teaching Aims:

The student will

- be able to analyse circuits of telecommunications and highfrequency engineering and assess their frequency and time responses.
- be familiar with methods commonly used in telecommunications.
- be able to plan and solve subject-relevant measuring problems.
- observe relevant regulations and standards.

#### Contents:

3<sup>rd</sup> Year :

Linear Two-Pole Networks:

Characteristics, applications.

Linear Four-Pole Networks:

Characteristics, logarithmic scales, matching, level measurement.

Transmitter:

Frequency and pulse response.

Analogue Filters:

Frequency and time range, pole/zero point analysis, computer-aided filter design.

Sound-Converters:

Microphone, loudspeaker, measurement technology.

Signals and Systems:

Linear and non-linear systems; time and frequency range, continuous-time and discrete-time signal analysis.

4<sup>th</sup> Year :

Lines:

Harmonic excitation, pulse response, Smith-Diagram, optical signal transmission, measurement technology.

Frequency Conversion:

Modulation, mixing and applications.

5<sup>th</sup> Year :

Switched Networks:

Architectures, mobile communication.

Electromagnetic Compatibility.

Basic concepts, measuring technology, interference suppression.

Audio-Visual Electronic Media:

Analogue and digital audio technology. Analogue and digital image processing.

### 2.2 TECHNICAL COMPUTER SCIENCE

#### Training and Teaching Objectives:

The student will

- have a sound knowledge of the basic concepts of information processing and its applications to hard and software.
- be able to deal with relevant complex assignments considering methods of software design and quality assurance.
- observe relevant regulations and standards.

**Contents:**

4<sup>th</sup> Year :

Software:

Operational Systems, data structures, algorithms and programs.

Software Engineering:

Methods, structures, quality assurance.

Microelectronics:

Computer architectures, storage hierarchies, memory management; applications of microprocessor systems to relevant areas; emulation.

5<sup>th</sup> Year :

Software:

Program libraries, programming languages, screen graphics, data base systems and applications, data protection; quality management in software design, cost-benefit analysis; re-engineering.

Microelectronics:

Complex peripheral systems, special makes and fields of application of processors, microprocessor application in parallel processes.

Digital Signals and Systems:

Information theory, coding, error protection, data transmission, interfaces.

Network Technology:

Topologies, access procedures, protocols, OSI-layer model, heterogeneous systems.

### 2.3 LABORATORY

Continuation of compulsory subject "Laboratory" of section A.

**Contents:**

4<sup>th</sup> and 5<sup>th</sup> Years :

Practical training in major areas of compulsory subjects "Fundamentals of Electrical Engineering", "Electronics and Digital Technology", "Industrial Electronics", "Telecommunications and Radio Frequency Engineering", "Technical Computer Science".

Joint projects with "Manufacturing Technology and Design" and commercial subjects.

### 2.4 WORKSHOP-LABORATORY

Continuation of compulsory subject "Workshop-Laboratory" of section A.

4<sup>th</sup> Year :

Digital Engineering:

Layout, installation, repair, and test of microprocessor controlled assembly groups and devices. Data technology.

Low- and Highfrequency Engineering:

Layout, installation, repair, and tests of analogue and digital assembly groups and devices. Electromagnetic compatibility.

Automation Engineering:

Architecture, installation, and test of control systems. Design of basic programs.

Computer Engineering:

Upgrading, configuration and repair of computer systems. Bus and network systems. Design of test programs.

Production Preparation:

Analysis of work routines, rate settings, test and manufacturing devices, ergonomic aspects of work places. Monitoring and checking of time limits and test devices provided by quality management.

### **B.3 BIOMEDICAL ENGINEERING**

#### **3.1 TELECOMMUNICATION ENGINEERING**

##### **Training and Teaching Aims:**

The student will

- be able to analyse circuits of telecommunications and assess their frequency and time responses.
- be familiar with methods commonly used in telecommunications.
- be able to plan and solve subject-relevant measuring problems.
- observe relevant regulations and standards.

##### **Contents:**

3<sup>rd</sup> Year :

Linear Two-Pole Networks:

Characteristics, applications.

Linear Four-Pole Networks:

Characteristics, logarithmic scales, matching, level measurement.

Transmitter:

Frequency and pulse response.

Analogue Filters:

Frequency and time range, pole/zero point analysis, computer-aided filter design.

Sound-Converters:

Microphone, loudspeaker, measurement technology.

Signals and Systems:

Linear and non-linear systems; time and frequency range, continuous-time and discrete-time signal analysis.

#### **3.2 ANATOMY AND PHYSIOLOGY**

##### **Training and Teaching Aims:**

The student will

- display a fundamental knowledge of the human body and its functions .
- understand the requirement of medicine.
- be familiar with relevant medical terminology.

##### **Contents:**

4<sup>th</sup> Year :

Anatomy:

Cell structure, cell division; tissue; orthopaedic apparatus; cardinal and vascular systems; respiratory system; digestive system, urogenital tract; sexual reproduction, development and partus; central nervous system.

Terminology:

Parts of the body and their location in Latin and Greek; introduction to clinic and practice.

5<sup>th</sup> Year :

Physiology:

Basic cell functions; formation and preservation of bioelectrical potentials; physiology of the nervous system; biophysics of the muscle; blood, cardio-circulatory system; respiration; kidney; metabolic energy exchange; thermal balance and temperature regulation; endocrinal system; physiology of sense organs.

### 3.3 IMAGE GENERATING SYSTEMS

#### **Training and Teaching Aims:**

The student will

- know the layout and function of image generating systems and devices used for diagnosis and therapy.
- know the basic concepts of computer-aided image processing.
- be able to comment upon questions of radiation protection.
- be capable of planning and solving subject -relevant measurement problems.
- observe relevant regulations and standards.

#### **Contents:**

4<sup>th</sup> Year :

TV-Systems with Sound and Image Storages:

Transmission and recording methods, recording and reproduction devices; nuclear resonance scanning; ultrasonic devices.

5<sup>th</sup> Year :

Radio Diagnosis:

X-ray radiation, characteristics, generation, devices.

Radiation Protection:

Risks of radiation, safety precautions, regulations and standards.

Image processing and image archiving.

### 3.4 BIOMEDICAL ENGINEERING

#### **Training and Teaching Aims:**

The student will

- know the construction and function of devices used for diagnosis and therapy.
- be provided with fundamental concepts of highfrequency engineering and its applications in biomedical engineering.
- be able to solve subject-relevant problems.
- be able to prepare and perform subject-oriented measurement assignments.
- observe relevant regulations and standards.

#### **Contents:**

4<sup>th</sup> Year :

Biomedical Sensor Engineering:

Measuring and signal processing of biomedical characteristic quantities.

Oscillation Generation:

Feedback, oscillation, PLL, frequency stabilisation.

Electronic Devices for Diagnosis and Therapy:

Measurement of blood pressure, pulse and blood flow, stimulation current diagnosis, function and circuit diagrams, problems with operation, reasons for interferences and measurement errors.

5<sup>th</sup> Year :

Highfrequency Amplifiers:

HF-parameter, performance diagram, matching, transmission amplifier, highfrequency amplifier.

Microwave Engineering:

Generation, amplification, processing.

Electronic Devices for Diagnosis and Therapy:

Electrocardiography, phonocardiography, electromyography, electroencephalography, pulmonary function analysis, cardiac catheterisation, patient monitoring, electrotherapy; highfrequency-, stimulation current - and thermal therapies;

electrosurgery, technology of implants, laboratory medicine engineering; functions and circuit diagrams; problems with operation, reasons for interferences and measurement errors; safety for electromedical devices, regulations and standards; electromagnetic compatibility and measurement technology.

### 3.5 LABORATORY

Continuation of compulsory subject “Laboratory“ of section A.

**Contents:**

4<sup>th</sup> and 5<sup>th</sup> Years :

Practical training in major areas of compulsory subjects “Fundamentals of Electrical Engineering“, “Electronics and Digital Technology“, “Industrial Electronics“, “Telecommunication Engineering“ , “Image Generating Systems“, “Biomedical Engineering“.

Joint projects with “Manufacturing Technology and Design“ and business subjects.

### 3.6 WORKSHOP-LABORATORY

Continuation of compulsory subject “Workshop-Laboratory“ of section A.

4<sup>th</sup> Year :

Digital technology:

Layout, installation, repairing and testing of microprocessor controlled assembly groups and devices. Data technology.

Low- and Highfrequency Engineering:

Layout, installation, repairing and testing of analogue and digital assembly groups and devices. Electromagnetic compatibility.

Automation Engineering:

Architecture, installation and testing of control systems. Design of basic programs.

Biomedical Engineering:

Set-up and testing of measurement devices and electrodes (metal, plastics, glass), applications to common models. Transducers, biological signals. Image generating measurement methods.

Production Preparation:

Analysis of work routines, rate settings, test and manufacturing devices, ergonomic aspects of work places. Monitoring and checking of time limits and test devices provided by quality management.

### MANDATORY WORK PLACEMENT

**Training and Teaching Aims:**

The student will

- be able to apply the knowledge and skills acquired in theory lessons and practical training programmes to actual business practice.

**Organisation and Contents:**

Mandatory work placement must last for at least eight weeks; it is advisable to split it into two four-week periods, however. The first part shall mainly comprise handicraft activities, while the second one should provide experience in engineering and business organisation. Preparation and review of mandatory work placement has to include issues on social and labour legislation.

The student has to hand in a mandatory work placement report to the head of the department documenting his activities and acquired skills.

### C. OPTIONAL SUBJECTS, NON-OBLIGATORY PRACTICE AND TUTORIALS

## C.1 OPTIONAL SUBJECTS

### SECOND MODERN LANGUAGE

(French, Italian, Spanish, Serbo-Croatian, Hungarian). Compulsory subject English shall apply analogously.

#### COMMUNICATION AND PRESENTATION

##### **Training and Teaching Aims:**

The student will

- will know basic concepts of free speech, body language, discourse and discussion techniques.
- apply the rules of communication and discourse techniques to conversations and discussions.
- employ presentation aids efficiently.
- consider the basic concepts of communication concerning short speeches, job interviews, project presentation and discussions.

##### **Contents:**

1<sup>st</sup> to 5<sup>th</sup> Year:

Fundamentals:

Levels of Communication and Discourse. Conscious and unconscious transfer of information.

Discourse:

Basic discourse techniques, initiative. Preparation of discourse, argumentation; dealing with questions and delicate conversational situations. Job interviews.

Short Speeches:

Respiration and voice (respiration techniques, breathing exercises, speech intervals,; pronunciation and intonation. Speech exercises. Gestures and facial expression during the speech, eye contact, movements in space. Preparing and giving short speeches.

Presentation:

Disposition and structure; systematic preparation. Utilisation of presentation aids ( charts, overhead, slides, computer aided presentation); preparation and organisation of project presentation.

Discussion:

Fundamental concepts (dynamics, routines, rules); dealing with questions and objections; preparation and organisation of discussions.

## C.2 NON-OBLIGATORY PRACTICE

### PHYSICAL EDUCATION

See Federal Law Gazette 37/1989

## C.3 TUTIONS

##### **Training and Teaching Aims:**

Students who show a contemporary performance drop, but are principally qualified and prepared to work, will be provided with knowledge and skills needed to achieve training and teaching aims.

##### **Contents:**

Contents of the corresponding compulsory subject shall apply analogously; they are limited to repetitions and exercises.

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