Physik- und Akustik-Ausbildung in Polen am Beispiel der Adam Mickiewicz Universität in Poznań
Edward Hojan, Dorota Hojan-Jezierska*

Institute of Acoustic, University of Poznań -Poland; *Chair of Biophysics, Medical Academy of Poznań-Poland

Email: hojanaku@amu.edu.pl

Introduction

Poznań, a former capital of Poland, the roots of which go back to the 9-th century, is the largest city of the Wielkopolska region. Today the historical stronghold on the Warta River is one of the leading economic, cultural and academic centres of Poland. 580,000 people inhabit Poznań. It is a large industrial and an important communication centre. Poznań has 7 theatres, 18 museums, 64 art galleries, concert hall, many orchestras and 28 choirs. Two Poznań choirs "Poznań Nightingales" and "Poznań Skylarks" are world-renowned. Equally well known in the world is music or theatre competitions, such as H. Wieniawski Violin Competition or the "Malta" theatre festival.

Poznań is the third largest academic centre in Poland (after Warsaw and Cracow). It has 15 institutions of higher learning and 56 research and development institutes. State institutions provide education to about 70,000 students. Adam Mickiewicz University is the largest academic institution. Adam Mickiewicz University was established in 1919. Eleven faculties and several smaller institutes offer about 150 degree and speciality courses; individual interdisciplinary, humanist and natural studies have also been introduced. Among the most popular faculties are law and administration, social studies and modern languages. A three-step model of education, comprising the bachelor's degree, master's degree and doctor's degree, is becoming more and more popular. About 2,000 students get grants for academic achievements. Every year over 30 students are awarded prestigious grants of the Minister of National Education and (or) well-known foundations. Scholarly and didactic work is carried out on university premises comprised of over 120,000 m2. Some of the university buildings were built at the beginning of 1990's: Collegium Physicum in Morasko and Hipolit Cegielski Collegium. The construction of Collegium Polonicum in Slubice, the largest educational centre on the Polish-German border, is well advanced. About 900 students study in Viadrina, on the western bank of the Odra River, at the same time being matriculated at Adam Mickiewicz University. The road to knowledge leads not only through lecture halls. The entire academic community has access to the Internet. The computer network has been recently extended to the University Library with over 4 million volumes. Student special interest groups are flourishing. Research work is sponsored by the Council for Scientific Research. The Careers Office, organised with PHARE funds manages the future of the students.

University - faculties

Biology, Chemistry, Educational Studies, Geography and Geology, History, Law and Administration, Mathematics and Computer Science, Modern Languages and Literature, Physics, Polish and Classical Philology’s, Social Sciences, Theology, Foreign Languages

Faculty of physics

The Faculty of Physics comprises now the Institute of Acoustics, the Institute of Physics and the Astronomical Observatory, the beginning of which is also dated 1919 - the decisive year for Poznań's scientific circle. Today, 52 titular professors are employed at the Faculty of Physics (26 of them as ordinary ones).

INSTITUTE OF ACOUSTICS comprises:

Electroacoustics Division, Prof. dr. Hab. Edward Hojan

Environmental Acoustics Division, Prof. dr. Hab., Rufin Makarewicz

Molecular Acoustics Division, dr. Hab. A. Skumiel

Psycho-and Room Acoustics Division, Prof. dr. Hab. Edward Ozimek

In Cupertino with the Medical Academy of Poznań we lead three-year day courses for licentiate in

Hearing Prosthetics and Sound Design

The graduates who wish to continue studies for additional two years may be awarded with a Master's Degree in Physics (specialisation Acoustics) on completion of the complementary programme

Contents of some lectures (Hearing Prosthetics)

Environmental acoustics effects of noise on man, annoyance and its measures, average sound level and noise events, statistics of noise, noise events from a stationary source (industrial noise), noise from moving sources (road traffic noise, train noise, aircraft noise), "passive" noise control (noise barriers), "active" noise control (secondary sources)

Design and maintenance of hearing aids: lumped constants oscillating devices, free- and forced oscillations, mechanical generators of sound, electroacoustic and acoustic-electric transducers, headphones, microphones, hearing aids and their components (microphone, amplifier, control systems earphone, insert, power supply), categories of analog devices, programmable hearing aid systems, digital hearing aids, implants osseous and cochleous options auxiliary equipment, maintenance

Analysis of acoustic signals: Fourier series - applications to periodic signals, Fourier transformation - application to non-periodic signals, probability methods for random signal evaluation, analogue devices for signal analysis, digital signal analysis, experimental conditions for signal analysis

Acoustic measurements: acoustic measurements classification (simple direct and composed measurements), reference measurements: comparative, compensating, comparative-compensating, definition and specification calibration (extremal, original and correcting calibrations, calibration in case of reference measures), measuring devices and methods, principles of analogue-digital converting, attributes of digital measurement methods (elements of information theory and coding one), acoustic and telecommunica-
tion parameters (RMS, "crest factor", non-linear distortion coefficient), error calculus

*Fundamentals of physiology and pathophysiology of communication:* general structure of human organism, morphological and physiological characteristics of hearing organ, qualitative and quantitative evaluation of hearing impairment, methods of threshold and above-threshold audiometric measurements, general characteristics of organ of the labyrinthine sense, voice and speech organs, pedoaudiological and ontoneurological characteristics

*Hearing aid devices - measurements:* measurements of characteristics of hearing aids standards and recommendations, measurements in free field and in test box, evaluation of input-output relations (dynamic compression), evaluation of frequency. Response OSPL90 (Output Sound Pressure Level for 90 dB input), evaluation of Full On Gain characteristic, setting up Reference Test Gain, evaluation of Frequency Responses, measurement of Equivalent Input Noise, measurement of Total Harmonic Distortions (THD)

*Hearing aid - fitting:* social, psychological and psychoacoustics preconditions, requirements and expectations of patient, preliminary choice of hearing aid or other devices, hearing aid fitting procedures based on tonal audiometry data and employing: noise pulses, sounds of acoustic environment of patient, speech sounds; various means of protetics: mono- and binaural aerial and occlusive, hearing aids pocket size, behind-ear, in-ear, inter-channel, anchored implants and cochlea implants, CROS, directional microphone, role of ear insert, ventilation openings, practical training, hearing practice

*Pathology of hearing:* general characteristics of hearing organ dysfunction’s, stages of hearing diagnostics, transmission impairment, acute and chronic otitis, ear injuries, inborn defects, receiving impairment, Meniere's disease, acoustic injury, presbyacusis, neurona of static-hearing nerve, genetically conditioned hearing impairment, buzzing in ears, audiometry of induced potentials, ototension, impedance audiometry.

*Otoplastics:* anatomy of external ear, making impression of ears, earmould production techniques, parameters of earmould and shells: shape, material, tubing, venting, dampers; influence of earmould parameters on quality of signal, prevention of feedback and occlusion effect, designing of individual earmoulds for patients

*Tonal audiometry:*

Contents: testing of hearing: introduction testing, tunes test, hearing threshold of air conduction, hearing threshold of bone conduction, above threshold testing, diagnostic value, adaptation, tiredness, association test hearing impairment: conductive, sensorineural, retro-cochlear, mixed, recruitment, medical certification psychogenaes deafness: simulation, dissimulation, aggravation

**Survey of the University Institutions Teaching Acoustics In Poland**

The higher university education in Poland is either state-owned or private. As a rule, the education provided by state owned schools is free. The subject of Acoustics is not taught in private schools. In this survey a directory of schools will be given with the details of studies where Acoustics is available, including the numbers of students, hours and the topics taught in the lectures and tutorials.

Total number of students in the state institutions of higher education at the university level amounts to 1.082,000, which makes 28 students per 1000 citizens. Presently in Poland among the state-owned educational institutions, there are 13 Universities, 18 Technical Universities, 8 Musical Academies, 9 Agricultural Academies, 5 Economy Academies, 8 Pedagogical High Schools and 10 Medical Academies. The physics of mechanical and acoustical waves is the subject of great interest to many scientists and technologists. The strong need to acknowledge the interaction between human’s reaction on the waves, their perception then and so on has increased recently to a great extent. There for Polish Universities have taken into account the elements mentioned above in preparation of the syllabus for the students.

**Teaching Acoustics**

I wish to concentrate the attention on the courses in Acoustics held in some of Polish Universities and Academies,

**Tab.A (Total number of students)**

1. University of Technology Wrocław, - Faculty of Electronics 212
   - Faculty of Architecture 150
   - Faculty of Environmental Engineering 160
   - Faculty of Basic Problems of Technology 25
2. Adam Mickiewicz University, Poznań
   A) Institute of Acoustics 110
   B) Musicology 25
3. University of Technology, Poznań
   Institute of Applied Mechanics 15
4. University of Technology, Gdańsk
   Faculty of Sound Engineering 87
5. University of Gdańsk, Gdańsk
   Institute of Experimental Physics 5
6. Fryderyk Chopin Academy of Music, Warszawa
   A) Faculty of Sound Engineering 10
   B) Faculty of Composition 12
7. Warsaw University, Warszawa
   Institute of Musicology 30
8. University of Mining and Metallurgy, Kraków
   Faculty of Mechanics and VibroAcoustics 30
9. Academy of Music, Kraków
   Faculty of Composition, Conducting, and Theory of Music, 10
   5
10. University of Technology, Gliwice
    Institute of Physics 150
11. University of Technology, Łódź, Branch of Bielsko Biała
    Faculty of Environmental Engineering 170
12. University of Silesia, Katowice
    Institute of Chemistry 20
13. Institute of Oceanology, Polish Academy of Sciences, Sopot 3
14. Pedagogical University of Rzeszów
    A) Institute of Physics, 27
    B) Institute of Technology 20
15. Rzeszów University Technology
    - Faculty of Civil and Environmental Engineering 100

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