

## **TRAINING PROGRAM IN DISCIPLINE: Mathematics**

### **1. Basic information**

*Domain: Natural Sciences*

*Discipline: Mathematics*

*Degree awarded: PhD in Mathematics*

### **2. Training demand**

The knowledge-based society requires highly skilled experts in various branches of industry, banking system, high schools ranking among the top ones, higher education and research and development units. According to the through investigations mathematicians are commonly those with least unemployment rate with lowest unemployment rate for the PhDs. This is a consequence of training which is being implemented and which is based on utmost scrutiny and a high-level analysis. Moreover, the mathematical research skills lead to the habit of checking all details and foreseeing possible opportunities which is believed to be indispensable in a modern society. With such a profile of research and related skills PhD in mathematics are especially valued as possible employees in areas that require sophisticated analytical skills not to be learned through traditional courses. Last but not least there is some demand of employing new instructors and assistant professors at universities and colleges in Poland due to the fact of increasing generation gap that has been observed. Moreover, graduates with attitude towards interdisciplinary research will bring some new ideas and possible influence future research directions.

### **3. Detailed entry requirements**

Mathematics graduates are eligible for doctoral training in mathematics. The candidates are advised to get in touch with possible future supervisors and start cooperation prior to the examination procedure. Future candidates are advised to investigate topics related to seminars held in the discipline of mathematics and at Lodz University of Technology as well as the formal and informal research requirements demanded by research groups. The choice of preferable research group prior to entrance examination is warmly advised since not all existing main branches of mathematics are present at LUT.

The enrolment exam includes a discussion on mathematical interests of candidates pertaining to:

- A) their MSc. thesis whose main ideas are to be presented;
- B) scientific achievements obtained so far- if any;
- C) classical oral exam covering the following topics (questions are formulated by the commission during discussion):
  - 1. Mathematical analysis (continuity, differentiability and integrability of functions of one and several variables - basic notions, theorems and relations).
  - 2. Examples of Banach spaces (space of continuous functions, spaces of integrable functions with power greater or equal to 1 - their properties).
  - 3. Fundamental theorems in functional analysis (Hahn-Banach, Banach-Steinhaus, open mapping, closed graph, Banach-Alaoglu) with necessary background information.
  - 4. Fundamentals in topology (continuity, compactness, connectedness, homeomorphisms).

5. Lebesgue measure and integration (construction, integrability, modes of convergence, comparison with the Riemann Integral).
6. Basics of probability theory.
7. Linear algebra (Jordan matrices, eigenvalues, linear mappings)

#### 4. Teaching methods

Teaching methods vary from course to course reflecting the teaching attitude towards mathematics. These comprise traditional board and chalk lectures, presentations with details being presented on the board, seminars, projects and case study problem solving tutorials. Very often a sort of mixed method is employed. There are offered courses allowing for broadening of mathematical knowledge and developing mathematical skills. Level of the courses is based on the profile of candidates and so are the methods which would be chosen through the course.

#### 5. Graduate's profile

Doctorate holder in mathematics knows and understands the worldwide scientific knowledge related to the area of PhD thesis and their implications for practical applications, especially in the field of engineering. The graduate can perform thorough analysis and synthesis of scientific results in order to identify and solve research task with introduction of innovative solutions and observations. The graduate can plan development and inspire others to participate in discussions, problem solving, also in an international environment. The graduate is ready to start independent scientific research, undertake challenges both in science and society, putting emphasis on ethical aspects and social impact of undertaken tasks.

#### 6. Training plan

First year (Semester 1 and 2)		
No.	Subcategory	Subject
1	E	Entrepreneurship
2	CC1	Modern Mathematical Analysis 1
3	CC2	Modern Mathematical Analysis 2
4	CC3	Stochastic Processes I
5	CC4	Stochastic Processes 2
6	CC5	Applied Functional Analysis 1
7	CC6	Applied Functional Analysis 2
Second year (Semester 3 and 4)		
No.	Subcategory	Subject
1	CC7	Mathematical Methods in Life Sciences and Engineering 1
2	CC8	Mathematical Methods in Life Sciences and Engineering 2