The growth of mathematical culture in the Lvov area in the autonomy period (1870–1920)

PolytechnIc school in Lvov

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CHAPTER III

POLYTECHNIC SCHOOL IN LVOV

3.1. Introduction

In 1811 the emperor Francis I agreed to create a real school in Lvov. Its opening took place in November 1817. The school had a technical profile and was considered a promise of the creation of a higher technical school. As result of the Galician State Seym's efforts, in 1835 the emperor Ferdinand I transformed the Real School into the Imperial Real-Commercial Academy, in which teaching of technical topics was below the secondary school level.

Further actions of State Seym resulted in strengthening the Academy with three-year departments of technology and country-farming and naming it Imperial Technical Academy, this time establishing it as a higher technical school in Lvov. On 4th November 1844 the inauguration ceremony began activity of the Academy, which contained the university department of Civil Engineering.

The Academy had two directions, technical (three-year) and commercial (one-year, in 1853–1854 it was changed into a secondary school), and it contained a two-year Real School. There were six departments: Mathematics, Physics, Mechanics, Chemistry, Civil Engineering and Land Surveying, where seven professors, six readers, five teachers of languages and drawing and three assistants taught. The Court Educational Committee in Vienna decided about the teaching programme and major matters of the Academy. The head teacher of the Technical Academy in 1844–1849 was professor doctor Florian Schindler. It provided education in all areas of engineering knowledge, and graduates received the title of an engineer of all specialities. In 1848–1850 the Technical Academy was closed.

Reconstruction of the school (after bombing during the Spring of Nations) and the organization of beginning of lessons was held by the interim head teacher of Academy, professor Alexander Reisinger – the chair of the Mathematics department – who did much for Technical Academy. Thanks to Reisinger fight for the polonization of Academy was avoided, as little by little he manned departments with Poles. After appointment of prof. Reisinger as a permanent head teacher of the Academy, the management of Mathematics department (in 1852) was taken by professor doctor Wawrzyniec Żmurko, the first Pole among professors of Academy, to whom mathematics in Lvov owes very much and whom we consider the pioneer of the Lvov mathematical school.

In Lvov in 1844–1872, the Technical Academy with German language of instruction existed. Besides Lvov, in Galicia there was no chances of starting another technical college. A Technical Institute existed in Cracow since 1834 with Polish as language of instruction, which for this reason was more popular

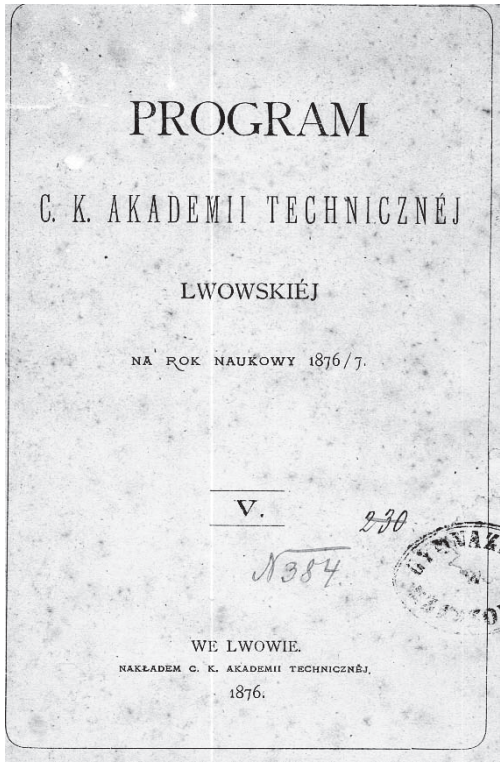
than the Polytechnic School in Lvov till 1872. The authorities of Austria downgraded the Institute in Cracow to the secondary school level.

In this chapter we present information about teaching of mathematics and its creators at the Polytechnic School (Technical Academy) in Lvov. Therefore I analyse teaching programmes of the c.k. Imperial Polytechnic School (Techniak Academy) in Lvov from 1876–1918.

Programmes of the Polytechnic School include the following information:

– Regulations for examinations and awarding certificates at the Polytechnic School, which were determined according to the Order of the Minister of Religion and Enlightenment in league with Minister of the Interior and Trade in Vienna.
– The register of lectures, teaching programmes, schedules of teaching which were placed in the form of tables for each faculty.
– Individual positions, information about the rector, the vice-rector, deans of each faculty, professors, private readers, assistants of professors, paid readers, assistants, tutors, teachers, honours and appointing honorary professors.

Reports also contain information about offices, libraries, institutes, national experimental stations, and makeup of examination boards.



PROGRAM

C. K. AKADEMII TECHNICZNÉJ

LWOWSKIÉJ

NA ROK NAUKOWY 1876/7.

V.

230

N384

WE LWOWIE.

NAKŁADEM C. K. AKADEMII TECHNICZNÉJ.

1876.

The title page of the students' schedule in the academic year 1876/1877.

Dzień	Rok	8—9	9—10	10—11	11—12	12—1	2—3	3—4	4—5
Poniedziałek	I.			Matematyka I.	Fizyka ogólna	Geometrya wykreślna	Rysunki z geometryi wykreślnéj		
	II.		Mechanika elementarna	Nauka o formach architektonicznych	Geodezya niższa		Rysunki ornamentalne i modelowanie		
	III.	Budownictwo I.			Mechanika budownicza		Rysunki ornamentalne i modelowanie		
	IV.	Budownictwo II.	Rysunki z budownictwa II.		Technologia mechaniczna	Petrografia	Rysunki z budownictwa II.		
Wtorek	I.	Rysunki ornamentalne i modelowanie		Matematyka I.	Fizyka ogólna	Geometrya wykreślna	Rysunki z geometryi wykreślnéj		
	II.				Rysunki form architektonicznych		Rysunki z geodezyi niższéj		
	III.	Budownictwo I.		Encyklopedya machin	Rysunki z budownictwa I.		Rysunki z budownictwa I.		
	IV.	Budownictwo II.	Rysunki z budownictwa II.			Petrografia			
Środa	I.	Rysunki ornamentalne i modelowanie		Matematyka I.	Fizyka ogólna	Geometrya wykreślna	Rysunki z geometryi wykreślnéj		
	II.		Mechanika elementarna	Nauka o formach architektonicznych	Geodezya niższa		Rysunki ornamentalne i modelowanie		
	III.	Budownictwo I.	Mechanika budownicza	Rysunki z mechaniki budowniczéj			Rysunki ornamentalne i modelowanie		
	IV.	Rysunki z budownictwa II.			Technologia mechaniczna	Petrografia	Rysunki z budownictwa II.		
Czwartek	I.	Rysunki ornamen. i modelowanie		Matematyka I.	Fizyka ogólna	Geometrya wykreślna	Rysunki z geometryi wykreślnéj		
	II.				Rysunki form architektonicznych		Rysunki z geodezyi niższéj		
	III.	Budownictwo I.		Encyklopedya machin	Rysunki z budownictwa I.		Rysunki z budownictwa I.		
	IV.	Budownictwo II.	Rysunki z budownictwa II.			Petrografia			
Piątek	I.		Matematyka, kurs I.		Fizyka ogólna	Geometrya wykreślna	Rysunki z geometryi wykreślnéj		
	II.				Geodezya niższa		Rysunki ornamentalne i modelowanie		
	III.	Budownictwo I.	Mechanika budownicza				Rysunki ornamentalne i modelowanie		
	IV.	Rysunki z budownictwa II.		Encyklop. budowy dróg i robót wodn.	Technologia mechaniczna				
Sobota	I.		Matematyka, kurs I.		Geometrya wykreślna				
	II.			Ćwiczenia z geodezyi niższéj					
	III.	Budownictwo I.		Encyklopedya machin	Rysunki z budownictwa I.		Rysunki z budownictwa I.		
	IV.	Rysunki z budownictwa II.		Rysunki z encyklopedyi budowy dróg i robót wodnych		Encyklop budowy dróg i robót wodn.	Rysunki z budownictwa II.		

Schedule of classes for students in the faculty of Civil Engineering in the academic year 1876/1877.

SPIS WYKŁADÓW.

I. Nauki matematyczne.

I. Matematyka kurs I.

Profesor: **Dr. Władysław Zajączkowski.**

(Tygodniowo 6 godzin wykładu w obudwu półroczach).

I. Zasady analizy wyższej. *a)* Wstęp do analizy: Teorya działań. Szeregi i iloczyny nieskończone. Równania algebraiczne. Wyznaczniki i sposoby rugowania. Ilości zmienne i ich funkcye. *b)* Rachunek różniczkowy: Różniczki i pochodne funkcyi jednej i wielu zmiennych. Wzór Taylora i Maclaurin'a Symbole nieoznaczone. Maxima i minima. Styczność i krzywizna krzywych płaskich i przestrzennych. Styczność powierzchni. *c)* Rachunek całkowy: Całki określone i nieokreślone. Sposoby całkowania. Całki funkcyi algebraicznych i przestępnych. Przybliżone metody obliczania całek. Całki wielokrotne. Rektyfikacya i kwadratura linii krzywych. Kwadratura i kubatura powierzchni.

II. Geometrya analityczna. *a)* Układy spółrzędnych na płaszczyźnie i w przestrzeni. Wzory trygonometryi płaskiej i sferycznej. Punkt, prosta i płaszczyzna. Miejsca geometryczne. *b)* Spółrzędne jednorodne. Stosunek podwójnego podziału i inwolucya. Teorya krzywych i powierzchni drugiego stopnia.

Fragment of the list of lectures, Mathematics – course 1 conducted by Władysław Zajączkowski, 6 lecture hours per week, in both I and II term.

2. Repetytoryum matematyki elementarnej.

Profesor: **Dr. Władysław Zajączkowski.**

(Tygodniowo 2 godziny wykładu w obudwu półroczach).

Powtórzenie i uzupełnienie ważniejszych ustępów elementarnej matematyki.

3. Matematyka kurs II.

Profesor: **Dr. Placyd Dziwiński.**

(Tygodniowo 6 godzin wykładu w obudwu półroczach).

1. Analiza wyższa. *a)* Teorya całek określonych: Sposoby obliczania całek określonych. Całki określone wielokrotne. Całki Eulera. Całki i szeregi Fouriera. *b)* Teorya funkcyi zmiennej urojonej: Różniczki i całki funkcyj zespolonych. Ogólne własności funkcyj analitycznych. *c)* Teorya równań różniczkowych: Formowanie równań różniczkowych. Teorya Jakobianu. Całkowanie równań różniczkowych zwyczajnych rzędu pierwszego i rzędów wyższych, osobliwie liniowych. Całkowanie układu równań różniczkowych zwyczajnych. Całkowanie równań różniczkowych cząstkowych rzędu pierwszego, liniowych i ogólnych z trzema zmiennemi. *d)* Zasady rachunku przemienności.

2. Teorya ogólna linii krzywych i powierzchni *a)* Styczność i krzywizna krzywych skośnych i powierzchni. Powierzchnie prostokreślne. Powierzchnie drugiego rzędu. *b)* Linie krzywe na powierzchniach: Linie krzywiznowe, geodezyjne i asymptotyczne. *c)* Kubatura i kwadratura powierzchni.

4. Repetytoryum matematyki wyższej.

Profesor: **Dr. Placyd Dziwiński.**

(Tygodniowo 2 godziny ćwiczeń w obudwu półroczach).

Powtórzenie i uzupełnienie wybranych ustępów z wyższej ma-

5. Geometrya wykreślna.

Profesor: **Dr. Mieczysław Łazarski.**

(Tygodniowo 5 godzin wykładu, 10 godzin rysunków w obudwu półroczach).

A. Metody geometryi wykreślnej:

1. Rzuty środkowe. 2. Szeregi punktów i pęki promieni, jednokreślność pęków i szeregów. Teorya krzywych rzędu drugiego. 3. Kolineacya, podobieństwo, pokrewieństwo, inwolucya, przystawanie i symetrya systemów płaskich. 4. Kolineacya i pokrewieństwo systemów przestrzennych. 5. Rzuty ortogonalne. 5. Axonometrya.

B. Teorya krzywych i powierzchni w ogóle.

1. Krzywe skośne i powierzchnie rozwijalne: *a)* Stożki i walce, krzywe skośne rzędu 3-go i 4-go; *b)* Linia śrubowa i powierzchnia śrubowa rozwijalna.

2. Teorya powierzchni skośnych: *a)* hyperboloida o jednej powłoce; *b)* paraboloida hyperboliczna; *c)* powierzchnie śrubowe skośne.

3. Teorya powierzchni rzędu 2-go nieprostoliniowych: *a)* Kula; *b)* powierzchnie obrotowe rzędu 2-go jako utwory kolineacyjne kuli; *c)* powierzchnie rzędu 2-go trójosiowe, jako utwory pokrewne z powierzchniami obrotowemi rzędu 2-go.

4. Teorya powierzchni obrotowych i obwiednich.

5. Konstrukcya cieniów własnych i rzuconych, oraz linij równego oświetlenia na powierzchniach.

Revision of elementary mathematics by W. Zajączkowski, 2 hours weekly in both terms Mathematics course II by Placyd Dziwiński, 2 hours weekly in both terms; Revision of higher mathematics by P. Dziwiński, 2 hours weekly in both terms. Descriptive geometry by Mieczysław Łazarski, 5 hours of lecture, 10 hours of recitations in both terms.

Since the beginning of the academic year 1872–1873, all lectures were in Polish, and professors elected prof. Felix Strzelecki, head of the Department of Physics, as Rector. At the end of October 1872 the Emperor approved the school reorganization project (containing the proposals to double the number of faculties), developed by college professors. Reorganized university consisted of three departments: Civil Engineering, Construction and Technical Chemistry. In 1875 a fourth university Faculty was established: Mechanical Engineering. The development of the Galician oil industry in 1884 caused the activation of a two-year university preparatory course in the field of mining and metallurgy in the Faculty of Mechanical Engineering. The success of the course, which served as a preparation to Leoben, in 1893 resulted in the transformation of the mining – metallurgical coal course into a three-year strictly mining one, qualifying for acceptance into the last year of study in Austrian mining academia. This was the first course (lasting till 1918) outside the structure of the faculty, reduced by the Ministry of Education in 1909 to two years. Another course outside the faculty structure from 1896 till 1920 was two-year course of surveyors, later a three-year one connected with the Faculty of Engineering.

In 1894 in Lvov there was a countrywide National Exhibition and during the ceremony the 50th anniversary of the Polytechnic School in Lvov was held. In the publication of *Politechnika Lwowska (1844–1945)*[79] [Lvov Polytechnic from 1844 to 1945] the authors mentioning this anniversary presented c.k. Lvov Polytechnics relative to other polytechnic schools of Austria, or Cislitawia. Data refer to the number of students in 1884.

City	Departments					
	Civil Eng.	Engineering	Mechanical	Chemical	General	Altogether
Vienna	345	90	287	206	40	968
Prague (Germ.)	79	19	79	88	–	268
Prague (Czech)	134	41	92	287	–	504
Graz (Germ.)	74	–	60	32	15	181
Brno (Germ.)	39	–	27	28	71	115
Lvov	89	28	37	46	–	200

The budget of the Ministry of Education in 1893 for the Polytechic in Vienna was 269 000 złr., for two Polytechnics in Prague – 260 000 złr., a small

[79] Editing committee: Jan Boberski, Stanisław Marian Brzozowski, Konrad Dyba, Zbysław Popławski, Jerzy Schroeder, Robert Szewalski (Chairman), Jerzy Węgierski, Wrocław Polytechnic University Press, 1993.

the Polytechnic Graz 113 700 złr. and a little less in the Brno Polytechnical School – 104 900 zlr. Despite appearance of good will, the discrimination in the allocation of funds for functioning is evident.

In 1896 the school's statute, prepared much earlier, was approved. The Statute of the c.k. Lvov Polytechnic School was in force until 1921. The principles of organization and methods of university teaching process contained in the statute were little by little implemented in the Austro – Hungary.

Since 1901 the Polytechnic School obtained the right to confer a doctoral degree – doctor rerum technicarum. Lecture rights – veniam legendi – could be obtained without doctoral degree, a track for professionals – practitioners was provided. From the field of mathematics and related sciences the following people habilitated:

– in 1878 Władysław Kretkowski in higher mathematics (lectured until 1892);
– in 1881 Gustaw Krammer in synthetic geometry and Karol Skibiński in mechanics of constructions;
– in 1886 Mieczysław Łazarski in descriptive geometry;
– in 1893 dr Kazimierz Żorawski in pure and applied mathematics;
– in 1913 Antoni Pawłowski in insurance mathematics.

Lectures of habilitated docents were accompanied by paid positions of docents, and from those positions respective chairs sometimes arose.

The first honorary doctorate was given to Maria Skłodowska-Curie. Since 1901, the rector was a member of the National Parliament, and since 1904 he could use the title of Magnificence. In 1904–1905 the main school building was expanded and later the second floor of the chemistry building was built. In 1907, a new Hydro-technical Department was created which in 1921 was combined with the Faculty of Engineering as the Water Department. In 1907, two Faculties were launched: Road and Bridge Engineering and Water Engineering, and this structure lasted until 1920. In the academic year 1913–1914 41 professors, 47 associate professors and 70 lecturers and assistants worked at the university. Before the outbreak of World War I, the number of students rose to almost two thousand.

In 1914 723 out of 1865 students were studying Civil Engineering, 586 – mechanical engineering, 251 – Technical Chemistry, 243 civil engineering (or architecture), 62 – Engineering Management, which was the first such faculty in Austria.

In the 1914/15 academic year, lessons were not held. The school functioned until 1918. In the academic year 1918/19 the professors and the Polytechnic School authorities worked to the available extent. The name Lvov Polytechnic School remained, and the predicate c.k. was removed. There were no lectures, but projects were consulted and overdue exams were credited. In 1919, women's equality was introduced. With great difficulties the academic year 1919/20 was opened, where 30% out of in 1500 students were military exempted for four months. The first regular academic year of (although begun later) the Polytechnic

in Lvov was the year 1920/21. At the end of 1919, Agricultural Academy in Dublany (est. 1856) and the Lvov School of Forests (est. 1874) were included in the Polytechnic in Lvov and a new Department of Agriculture and Forestry was created. Already in July 1920 the Polish Seym passed an act on academic schools, in which were mentioned universities, including the Lvov Polytechnic School. On the basis of that law a general meeting of professors developed the new statutes and a new name for the university, which was approved on June 28, 1921, by the Minister of Religion and Enlightenment.

The Polytechnic in Lvov included six faculties: General, Engineering, Architecture, Mechanical, Chemical, and Agriculture and Forestry.

The purpose of the General Faculty was the training of teachers of mathematics and natural science in secondary schools and of research workers for research institutes. According to professor Kazimierz Kuratowski, teaching programme of mathematics at the General Faculty was so wide that no faculty of a university in Poland had then a similar one. Six professors taught mathematics: Stefan Banach, Kazimierz Bartel, Kazimierz Kuratowski, Antoni Łomnicki, Stanislaw Ruziewicz, Włodzimierz Stożek, together with four assistant professors (Stefan Kaczmarz, Władyslaw Michał Nikliborc, Adam Maksymowicz and Wladyslaw Orlicz), all famous Polish mathematicians. Despite this fact, General Faculty only existed during 1921–1933 and its most famous graduate was Stanisław Ulam.

The General Department, including the training of mathematics, was the aftermath of unusually developed culture of mathematics in the Lvov Polytechnic School.

3.2. The role of mathematics in polytechnic education

First of all we will give rules for the entrance exams, exams after each year and the student status. The entrance examination concerned graduates of gymnasia of humanist type, in which the descriptive geometry and line drawings were not compulsory subjects. To become students of the Polytechnic School they had to pass the entrance exam in those subjects with at least satisfactory mark. The examination did not concern graduates of real gymnasia. Requirements for these examinations were the following:

Descriptive geometry – the exact knowledge of the method of rectangular projections, particularly projections of points, straight lines and plane figures onto three planes of projection. Traces of straight[80] lines and planes[81]. Edges of planes; point of perforations of a plane by a straight line. Rotation of a point

[80] *Trace of a straight line* – the intersection of a straight line with viewports.

[81] *Trace of the plane* – the plane determined by a pair of edge intersections viewports. The edges are called appropriately the horizontal trace and trace a vertical plane.

around a straight line. Contour[82] of a plane. Projection of the circle. Projections, sections and penetration[83] of pyramids and prisms.

Hand drawings – the realization of the perspective drawing from the model, representation of the leaf in the situation with the brush and in the detailed form.

Listeners of the Polytechnic School were divided into ordinary and extraordinary ones.

The following persons could be accepted as ordinary listeners:

– people who obtained the secondary school certificate, provided the graduates passed an examination in geometrical and freehand drawings.
– ordinary listeners of parallel technical Institutes transferring to Polytechnic School.

As extraordinary listeners could be accepted all those who did not possess qualification for ordinary listeners or wanted to attend only some lectures, but one needed to be 18 year-old and have preparatory knowledge necessary for understanding lectures they chose for themselves. Such listeners did not obtain certificates of progress and graduations.

Guests were allowed in lectures only in exceptional situations, with the Rector's permission. Only people that were qualified at the *maturity level or graduates of other polytechnic school or the University* could attend lectures as guests.

The Government Examination

To assess the knowledge and skills acquired at Polytechnic School in the range of general and technical disciplines one took so-called government examinations:

– **The first government examination**, in other words, a general one in preparatory studies; in this examination mathematical subjects could be found.
– **The second government examination**, or professional one in subjects of a specific technical occupation. In this examination mathematical subjects were not obligatory.

Mathematical subjects which were obligatory at the first government examination:

In the Engineering Faculty, in the examination knowledge of mathematics of I and II course and of descriptive geometry was obligatory.

In the Faculty of Civil Engineering, in the examination knowledge of mathematics of I course and of descriptive geometry was obligatory.

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[82] *Figure contour* – an image F′ on the plane β (viewport), formed by rotating the geom. Figure F, lying in the plane α, around the straight *t* being a common edge of (trace) of intersecting planes α and β.

[83] *Penetration of polyhedron* – a set of common points of the two surfaces. These are points where the edges of one polyhedron intersect the faces of the other.

In the Faculty of the Construction of Machines at the examination the knowledge from mathematics of I and II course and from the descriptive geometry was obligatory .

In the Faculty of Technical Chemistry, in the examination knowledge of mathematics of I course was obligatory.

Course Examinations – their aim was to obtain certificates in particular subjects; examinations took place openly under the supervision of the dean of the given faculty in which the examinee was registered. These examinations took place after the completion of lectures. In each faculty, a student could be admitted to course examinations in final subjects if he proved suitable attendance of lessons whose contents were obligatory in the second government examination in the given faculty.

Dates of examinations

Examinations took place to the end of winter or the summer semester.

Only ordinary listeners, with the confirmed attendance of lectures, recitations and revision courses could be admitted to the examination. The examination could not be repeated. The student could retake the examination only after he took again the same lecture.

3.2.1. Mathematical subjects

We present the topics of the lectures at the Faculty of Engineering on the basis of materials published by c.k. Lvov Polytechnic School.

SCHOOL YEAR	YEAR	SUBJECT	WEEKLY NUMBER OF HOURS PER HALF–YEAR						LECTURER
			WINTER SEMESTER			SUMMER SEMESTER			
			W	Ć	R	W	Ć	R	
1876/77	I	Mathematics course I	8	2	–	8	2	–	dr Władysław Zajączkowski
		Descriptive geometry	6	–	10	6	–	10	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	Wawrzyniec Żmurko
1877/78	I	Mathematics course I	8	2	–	8	2	–	Wawrzyniec Żmurko
		Descriptive geometry	6	–	10	6	–	10	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski
1881/82	I	Mathematics course I	7	2	–	7	2	–	dr Placyd Dziwiński
		Descriptive geometry	6	–	12	6	–	12	dr Mieczysław Łazarski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski

1883/84	I	Mathematics course I	6	3	–	6	3	–	dr Wawrzyniec Żmurko
		Descriptive geometry	6	–	12	6	–	12	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski
1884/85	I	Mathematics course I	6	3	–	6	3	–	dr Władysław Zajączkowski
		Descriptive geometry	6	–	12	6	–	12	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	dr Placyd Dziwiński
1885/86	I	Mathematics course I	6	3	–	6	3	–	Vacancy
		Descriptive geometry	6	–	12	6	–	12	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski
1886/87	I	Mathematics course I	6	3	–	6	3	–	dr Władysław Zajączkowski
		Descriptive geometry	6	–	12	6	–	12	Karol Maszkowski
	II	Mathematics course II	5	2	–	5	2	–	Vacancy
1887/88	I	Mathematics course I	6	3	–	6	3	–	dr Placyd Dziwiński
		Descriptive geometry	6	–	12	6	–	12	dr Mieczysław Łazarski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski
1888/89	I	Mathematics course I	6	3	–	6	3	–	dr Władysław Zajączkowski
		Descriptive geometry	6	–	12	6	–	12	dr Mieczysław Łazarski
	II	Mathematics course II	5	2	–	5	2	–	dr Placyd Dziwiński
1890/91	I	Mathematics course I	6	3	–	6	3	–	dr Władysław Zajączkowski
		Descriptive geometry	6	–	12	6	–	12	dr Mieczysław Łazarski
	II	Mathematics course II	5	2	–	5	2	–	dr Placyd Dziwiński
1891/92	I	Mathematics course I	6	3	–	6	3	–	dr Placyd Dziwiński
		Descriptive geometry	6	–	12	6	–	12	dr Mieczysław Łazarski
	II	Mathematics course II	5	2	–	5	2	–	dr Władysław Zajączkowski
1892/93	I	Mathematics course I	6	–	–	6	–	–	dr Władysław Zajączkowski
		Descriptive geometry	5	–	10	5	–	10	dr Mieczysław Łazarski
	II	Mathematics course II	6	–	–	6	–	–	dr Placyd Dziwiński

1893/94	I	Mathematics course I	6	–	–	6	–	–	dr Placyd Dziwiński
		Descriptive geometry	5	–	10	5	–	10	dr Mieczysław Łazarski
	II	Mathematics course II	6	–	–	6	–	–	dr Władysław Zajączkowski
1894/95	I	Mathematics course I	6	–	–	6	–	–	dr Władysław Zajączkowski
		Descriptive geometry	5	–	10	5	–	10	dr Mieczysław Łazarski
		Review of elementary mathematics	2	–	–	2	–	–	dr Władysław Zajączkowski
	II	Mathematics course II	6	–	–	6	–	–	dr Placyd Dziwiński
		Review of higher mathematics	2	–	–	2	–	–	dr Placyd Dziwiński
1895/96	I	Mathematics course I	6	–	–	6	–	–	dr Placyd Dziwiński
		Descriptive geometry	5	–	10	5	–	10	dr Mieczysław Łazarski
1895/96	I	Review of elementary mathematics	2	–	–	2	–	–	dr Placyd Dziwiński
	II	Mathematics course II	6	–	–	6	–	–	dr Władysław Zajączkowski
		Review of higher mathematics	2	–	–	2	–	–	dr Władysław Zajączkowski
1896/97	I	Mathematics course I	6	–	–	6	–	–	dr Władysław Zajączkowski
		Descriptive geometry	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	10	–	–	10	dr Mieczysław Łazarski
		Review of elementary mathematics	–	2	–	–	2	–	dr Władysław Zajączkowski
	II	Mathematics course II	6	–	–	6	–	–	dr Placyd Dziwiński
		Review of higher mathematics	–	2	–	–	2	–	dr Placyd Dziwiński
1897/98	I	Mathematics course I	6	–	–	6	–	–	dr Placyd Dziwiński
		Descriptive geometry	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	10	–	–	10	dr Mieczysław Łazarski
		Review of elementary mathematics	–	2	–	–	2	–	dr Placyd Dziwiński
	II	Mathematics course II	6	–	–	6	–	–	dr Władysław Zajączkowski
		Review of higher mathematics	–	2	–	–	2	–	dr Władysław Zajączkowski

1898/99	I	Mathematics course I	5	–	–	5	–	–	dr Władysław Zajączkowski
		Descriptive geometry	4	–	–	4	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
		Review of elementary mathematics	–	2	–	–	2	–	dr Władysław Zajączkowski
	II	Mathematics course II	5	–	–	5	–	–	dr Placyd Dziwiński
1899/00	I	Mathematics course I	5	–	–	5	–	–	dr Placyd Dziwiński
		Descriptive geometry	4	–	–	4	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
1899/00	I	Review of elementary mathematics	–	2	–	–	2	–	Vacancy
	II	Mathematics course II	5	–	–	5	–	–	Vacancy
1902/03	I	Mathematics course I	5	–	–	5	–	–	dr Stanisław Kępiński
		Descriptive geometry	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
		Exercises in elementary mathematics	–	2	–	–	2	–	dr Stanisław Kępiński
	II	Mathematics course II	5	–	–	5	–	–	dr Placyd Dziwiński
		Exercises in higher mathematics	–	2	–	–	2	–	dr Placyd Dziwiński
1903/04	I	Mathematics course I	5	–	–	5	–	–	dr Placyd Dziwiński
		Descriptive geometry	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
		Exercises in elementary mathematics	–	2	–	–	2	–	dr Placyd Dziwiński
	II	Mathematics course II	5	–	–	5	–	–	dr Stanisław Kępiński
		Exercises in higher mathematics	–	2	–	–	2	–	dr Stanisław Kępiński
1905/06	I	Mathematics course I	5	–	–	5	–	–	dr Placyd Dziwiński
		Descriptive geometry	5	–	–	3	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski

1905/06	I	Exercises in elementary mathematics	–	2	–	–	2	–	dr Placyd Dziwiński and assistant dr Lucyan Böttcher
		Practical exercises in descriptive geometry	–	1	–	–	1	–	dr Mieczysław Łazarski
	II	Mathematics course II	5	–	–	5	–	–	dr Stanisław Kępiński
		Exercises in mathematics course II	–	2	–	–	2	–	dr Stanisław Kępiński and assistant Wojciech Burtan
1906/07	I	Mathematics course I	5	–	–	5	–	–	dr Stanisław Kępiński
		Descriptive geometry	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
		Exercises in elementary mathematics	–	2	–	–	2	–	dr Stanisław Kępiński and assistant Franciszek Ulkowski
		Practical exercises in descriptive geometry	–	1	–	–	1	–	dr Mieczysław Łazarski
	II	Mathematics course II	5	–	–	5	–	–	dr Placyd Dziwiński
		Exercises in mathematics courseII	–	2	–	–	2	–	dr Placyd Dziwiński and assistant dr Lucyan Böttcher
1909/10	I	Mathematics I A	5	2	–	5	2	–	dr Placyd Dziwiński
		Descriptive geometry A	5	–	–	5	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry	–	–	6	–	–	6	dr Mieczysław Łazarski
	II	Mathematics II A	6	2	–	6	2	–	dr Zdzisław Krygowski
1910/11	I	Mathematics I A	5	–	–	5	–	–	dr Zdzisław Krygowski
		Exercises in mathematics I A	–	2	–	–	2	–	dr Zdzisław Krygowski
		Descriptive geometry A	5	–	–	3	–	–	dr Mieczysław Łazarski
		Drawings in descriptive geometry A	–	–	6	–	–	6	dr Mieczysław Łazarski
	II	Mathematics II A	5	–	–	5	–	–	dr Placyd Dziwiński
		Exercises in mathematics II A	–	2	–	–	2	–	dr Placyd Dziwiński
1911/12	I	Mathematics I A	5			5			dr Placyd Dziwiński
		Exercises in mathematics I A	2			2			dr Placyd Dziwiński
	I	Descriptive geometry	4			4			dr Kazimierz Bartel

1911/12	I	Drawings in descriptive geometry A	6	6	dr Kazimierz Bartel
	II	Mathematics II A	5	5	dr Zdzisław Krygowski
		Exercises in mathematics II A	2	2	dr Zdzisław Krygowski
1913/14	I	Mathematics I A	5	5	dr Placyd Dziwiński
		Exercises in mathematics I A	1	1	dr Placyd Dziwiński
		Descriptive geometry A	4	4	dr Kazimierz Bartel
		Drawings in descriptive geometry	6	6	dr Kazimierz Bartel
		Exercises in descriptive geometry	2	2	dr Kazimierz Bartel
	II	Mathematics II A	4	4	dr Zdzisław Krygowski
		Exercises in mathematics II A	2	2	dr Zdzisław Krygowski
	II	Seminar in mathematics I	2	2	dr Placyd Dziwiński

3.2.2. Content of lectures

MATHEMATICS COURSE I

The teaching programme of mathematics of the I course at **the Technical Academy** in **1876/77 and 1877/ 78** was the following:

The generalization of mathematical operations on the basis of quantities of any directions, operations, combining and substitution. Logarithms, powers, roots, determining convergent and divergent series on the basis of Newton's series. Solving equations of higher degrees with Horner method, representing their roots with decimal numbers or with series ordered according to powers of the parameter, according to whether their coefficients are usual numbers or terms ordered according to powers of the parameter. Decomposition of functional fractions into simple fractions with the Horner method. The theory of determinants with applications. Analytical geometry of the plane and the space, identification of curves and surfaces up to the second order. Arithmetic and reversible series, rules of the differentiable and integral calculus. The separation of elements of numerical equations on the basis of Fourier method, as well as by means of analytical geometry. Derivation of most important properties of the curvature of a line and a surface.

In **1878/79 the** programme was changed into the following:

Algebra – the evolution of the concept of number. Concept of function and classification of functions. Algebraic equations. Expansion of determinate and indeterminate equations of the first degree. Essential information about deter-

minants. Rules of study of continuous fractions. General properties of algebraic equations and their transformations. Solving two-term equations. Solving 2, 3, 4 degree equations. General theorems about the number of roots between given bounds. Manners of computing approximate root values of algebraic and sequent equations. Elimination theory. Concept of discriminant. Principal properties of quadratic forms.

Rules of differential and integral calculus – Differentiation of explicit and implicit functions of one variable. Taylor's theorem. The convergence of series. Fundamental series. Appointing of functions assuming indeterminate shape. The maximum and the minimum of one variable function. Decomposition of fractions into partial fractions. About tangents, asymptotes, singular points and the curvature of flat curves. Concept of the definite and indefinite integral. Manners of integrating by parts with series. The quadrature[84], the rectification[85] and cubature[86].
The analytical geometry – determination of a point on the plane and in the space. Straight line on the surface and a plane in the space. System of points on straight, line bundle on the plane and bundle of planes. The rule of the duality[87]. Curves of the second degree and their principal, metric and particular properties. Surfaces of the second degree and their basic properties. The straight and circular cut. Confocal surfaces of the second degree.

In **1881/82** programme was changed to the following:
General operations for arbitrary directions in the space. Deduction, on this basis, of Newton's series, of exponentials and logarithms, and the general theory of convergence of series. Deduction of angle-measuring and cyclo-metrical series. Poligonometry[88] on the plane and on the ball. Horner's technique and a short theory of determinants. Deduction, on this basis, of methods of decomposing

[84] *Squaring a flat geometric shape* – the task of graphing the square with the area equal to that of the given plane figure.

[85] Rectification of the arc – the problem of constructing. using ruler and compass, a segment whose length is equal to that of of the given arc.

[86] *Cubature* – volume.

[87] *The principle of duality* – duality principle – the principle which says that every true theorem of projective geometry in the plane-containing only the phrase "a point lies on a straight line", "lines intersect at the point", "point belongs to a conical" and "straight line is tangential to the conical" corresponds to other related claims dual, also true. To receive a statement of the theorem the word dual to replace with the word "point", the words "straight line" and, conversely, the phrase "point lies on a straight line" with "straight line passes through the point" and vice versa, the phrase "point belongs to the conical line", with the phrase ''straight line is tangent to the conical "and vice versa.

[88] *Poligonometry – poligonization* – surveying method for determining points in the field (point traverses), the fixed with underground and airborne signs; the points form traverses

functional fractions into simple fractions, of solving equations, and also of executing eliminations needed in the analysis. Analytical geometry with special regard to the theory of lines and surfaces of second degree. First rules of differential and integral calculus.

In **1883/84** programme was changed to the following:

The generalization of mathematical operations on the basis of quantities of arbitrary direction. Algebraic analysis, theory of equations and solving equations up to the fourth degree. Analytical geometry on the basis of oblique[89] axes on the plane and in the space, with special regard to objects of second order. Rules of differential and integral calculus with most important applications to geometry .

In **1884/85** programme was changed into the following:

Rules of higher analysis – beginning of differential calculus: function and its continuity. Differentiation of one variable function and implicit functions. Taylor's formula. Analytic applications of differential calculus. The theory of algebraic equations. Solving equations with numerical coefficients. Manners of elimination. Determinants – determining the value of fractions whose numerator or denominator becomes 0 or ∞. Decomposition of rational fractions into partial fractions. Maximum and minimum of a function. The convergence of infinite series. Expansion of functions into series and infinite products. Beginning of the integral calculus. The definite and indefinite integral. Manners of integration. Integration of rational and of some irrational algebraic functions. Integration of transcendental functions[90]. Differentiation and integration under the sign of integral.

Analytical geometry – coordinate systems on the plane and in the space and their transformations. Points and straight lines on the plane. Point, plane and straight line in the space. The relation of double partition. Involution[91]. The theory of curves of second degree. The theory of surfaces of second degree. The theory of tangents, asymptotes, singular points and curvature of planar curves. The rectification and the quadrature of planar curves. The quadrature and the volume of rotational surfaces. The strictly tangent plane, curvature, the twist of oblique curves. The theory of contact of surfaces.

(closed, open), the geometric design of at least 3 strings creates a network of polygons; polygonal networks are the basis for detailed situational measurements.

[89] *Oblique coordinate system* consists of two straight lines intersecting at an angle different from the 90^0. If from the point M we draw lines parallel to the axis, we obtain oblique coordinates of M: $x = OA$, $y = OB$.

[90] *Transcendental function*, the function which is not algebraic, the function f that for any non-zero polynomial in two variables does not satisfy the equation $W(x, f(x)) = 0$ for all x belonging to its domain. The transcendental functions include trigonometric functions, exponentials and their inverses.

[91] *Involution* – geometric transformation, under which point M is the image of point N, and N is the image of point M. After double application of the involution point M does not change its position, and hence the point M moves in the point N and point N in of the point M. An example of an involution is the inversion and symmetry.

The above-mentioned programme was not changed for the next four years and in **1887/88** it was changed into following:

The rule of higher analysis – introduction to analysis: theory of operations. Series and infinite products. Algebraic equations. Determinants and manners of elimination. Variable quantities and their functions. The differential calculus: differentials and derivatives of function of one or many variables. Taylor's and Maclaurin's formula. Indeterminate symbols. Maxima and minima. Tangency and curvature of planar and spatial curves. Contact of surfaces. The integral calculus: definite and indefinite integrals. Manners of integration. Integrals of rational, algebraic and spatial functions. Approximate methods of integral calculus. Multiple integrals. The rectification and the quadrature of curves. The quadrature and volume of the surfaces

Analytical geometry – coordinate systems on the plane and in the space. Formulas of planar and spherical trigonometry. Point, straight line and plane. Geometrical loci. Homogeneous coordinates[92]. The relation of double partition and involution. Theory of curves and surfaces of second degree.

This programme was in force up to **1913/14.**

In **1909/10** the subject "Mathematics course I" was defined as Mathematics I A and B where A was for Faculties of Engineering, the Water Engineering and the Course of Surveyors. B – for Faculty of Machine Construction.

In **1911/12 A** – for Faculties of Engineering, Hydro-technical and the Course of Surveyors, **B** – for the Faculty of Machine Construction

In **1913/14 A** – for Faculties of the Engineering, the Water Engineering and the Course of Surveyors.

MATHEMATICS COURSE II

The programme of teaching of mathematics of the course II in Technical Academy in **1876/77** and **1877/78** was the following:

Manners of integration and principal integral formulas, the integration by transforming, by parts, by decomposition, by reducing to rationality, by reduction and by means of series. Definite integrals and their properties. Manners of determining definite integrals. Euler's integrals, Fourier series and integrals. The rectification and the quadrature of curves

The volume and area of curvilinear surface[93]. Ordinary differential equations of the first order, some of higher orders. The theory of ordinary differential equations by means of infinite series. Integration of the system of simultaneous ordinary differential equations, particularly linear ones. The theory of singular

[92] *Homogeneous coordinates* is a way of representing n-dimensional points with $n+1$ coordinates. Homogeneous coordinates were introduced to geometry in 1827 by August Möbius in *Der barycentrische calcul*. In 1946, E. Maxwell used them to solve problems related to the projection.

[93] *Calculation* of the area of curvilinear surface requires the integral calculus.

solutions of ordinary differential equations, integration of partial differential equations of higher orders and linear ones. The theory of curvature of a surface. First rules of the commutative calculus, the theory of brachistachrone[sic][94] and geodesic lines[95].

In **1878/79** programme was changed to the following:

Applications of differential calculus:

To computing functional fractions that can appear as $\frac{0}{0}, \frac{\infty}{\infty}$, ∞^0, 1^∞, $(\infty, -\infty)$ for particular values of variables. To computing and distinguishing so-called "greatestness" and "leastness" of given functions. To the theory of curvatures of a line and a surface. To examining numerical equations with respect to the nature of their roots. Manners of integration, definite integrals and their properties, determining definite integrals, Euler and Fourier integrals. Application of the integral calculus to geometry. Ordinary differential equations of the first order, some of higher orders. Solving these equations by means of infinite series. The integration of the system of simultaneous ordinary linear equations. On linear solutions. On partial differential equations of the first order. The integration of some differential equations of higher order and linear ones. Rules of the calculus of the commutativity with applications of this calculus to solving geometrical exercises.

In **1881/82** programme was changed into the following:

The revision of the differential and integral calculus with supplements. The outline of the theory of curves, flat and the double slant and the theory of the surface of curves. The study about ordinary and partial differential equations with the special regard of lineal differential equations. The first rules of the calculus of commutativity with the use of some problems from the geometry and mechanics.

In **1883/84** the programme was changed into the following:

In the winter semester.

The revision of the differential and integral calculus with supplements. The general theory of curved lines and surfaces, especially algebraic.

In the summer semester:

The theory of differential equations. Rules of the calculus of commutativity.

In **1884/85** the programme was changed to the following:

Higher analysis – revision of the beginning of differential and integral calculus. The transformation of differential expressions. Formation of differential equa-

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[94] *Brachistochrone* – the shortest time curve; among all plane curves connecting two fixed points a and b not lying on the same vertical line, the curve along which a material point moving under the influence of constant force (e.g. gravity) travels the path ab in the shortest time. If there is no center of resistance, brachistochrone is a cycloid arc.

[95] *Geodesic line* – a curve lying on the surface which has the smallest length of all lines connecting two given points of the surface.

tions. The theory of Jacobian. Integration of ordinary differential equations of first order and higher order, especially linear ones. Integration of a system of partial differential equations of first order, linear and general ones with three variables. Manners of computing definite integrals. Euler integrals. Fourier integrals and series. Rules of the calculus of commutativity.

The above-mentioned programme was in force for the following 3 years, and was changed in **1888/89** as follows:

Higher analysis – the theory of definite integrals. Manners of computing definite integrals. Multiple definite integrals. Euler integrals. Fourier integrals and series. Theory of function of an imaginary variable. Differentials and integrals of complex function. General properties of analytic functions. Theory of differential equations. Formation of differential equations. The Jacobian theory. The integration of ordinary differential equations of the first order and higher orders, especially linear ones. Integration of a system of ordinary differential equations. Integration of partial differential equations of the first order, linear and general ones with three variables. Rules of the calculus of commutativity.

The general theory of curves and surfaces – the osculation and the curvature of oblique curves and surfaces. Ruled surfaces[96]. Quadric surfaces. Curves on surfaces. Curvature, geodesic and asymptotic lines. The capacity and the quadrature of the surface.

This programme was in force up to **1913/14**.

In **1909/10, the** subject "Mathematics course I" was defined as Mathematics I A and B where A – was for Faculties of: Engineering, the Water Engineering and Course of Surveyors. B – for the Faculty of the Construction of Machines.

In **1911/12 A** – for Faculties of Engineering, Hydro-technical and Course of Surveyors, B – for the Faculty of the Construction of Machines.

In **1913/14 A** – for Faculties of Engineering, Water Engineering and the Course of Surveyors.

DESCRIPTIVE GEOMETRY

The teaching programme of descriptive geometry at **the Technical Academy** in **1876/77, 1877/78, 1878/79** was the following:

Rectangular projections. Determination of all relations between the point, straight line and plane in rectangular projections. The projective perspective[97] (rectangular projective planes oblique to each other). Transforming prior problems in these projections.

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[96] *Ruled surfaces* – the surface, every point of which passes one or more straight lines, which make up, lying on the surface, e.g. a cone or a hyperboloid of one sheet. It may not be the surface of the drop-down.

[97] *Perspective* – convention in art, according to which, in fact, a straight parallel are presented as if they intersect at one point within or outside the image, the two systems are in perspective, if all the lines connecting corresponding points intersect at one point.

Construction of solid angles and flat-faced solids, intersecting these solids by straight lines, their plane sections and the mutual penetration. Transformations of planes of projections for points, straight lines and planes. Rules of axonometry in one, two, three dimensions. Construction of quadric curves and other important curves. Tangent and normal lines, touching of curves by each other. The construction of curvilinear surfaces and solids bonded by them, namely rotational, expandable, oblique (warped) and surfaces of higher orders. Plane sections of a surface, their crossing by straight lines and tangent planes, and mutual touching. So much in rectangular projections as in the projective perspective. The theory of shadows, the proper shadow, cast shadow, bright points and lines of the equal lighting. Rules of the free perspective and their application to the painter's perspective. Stonemasonry, flat slopes, cylindrical, cone-shaped and warped culverts and wings. Warped arches over gates and windows. Straight and warped cradles. Cone-shaped, globe-shaped , Czech and Prussian, cross-shaped, monastic, warped and flat arches. Straight, broken and curly stairs.

The teaching programme in **1881/82** school year at the Technical Academy transformed in imperial Polytechnic school was the following:

Point, straight, the surface and flat sides spatial compositions. Curved lines and surfaces. The contact and the penetration. The study of shadows. All about rectangular projections and the projective perspective. Axonometry. The free perspective. Carpentry[98] and stonemasonry.

This programme was not changed during the next 4 years and since **1887/88** was the following:

Methods of descriptive geometry – central projections. Rows of points and pencil of rays, geometrical transformations[99] of pencils and rows. The theory of curves of second order. Geometrical transformation, similarity, relation, involution, congruence and the symmetry of planar systems. Colineation and the *relation of spatial systems. Orthogonal projections. The axonometry*[100].

The theory of curves and surfaces in general – oblique curves and expandable[101] surfaces. Cones and cylinders, oblique curves of the 3rd and 4th order. The helix and the expanded helical surface.

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[98] *Carpentry* – craft dealing with performance of wooden constructions.

[99] *Colineation* – geometrical transformations.

[100] *Axonometry* – if one can determine the coordinates of the points of a spatial object, it is said to be related to the coordinate system Oxyz, but the point O is called the beginning of the system. We choose a plane π and the projection direction k not parallel to π. The method of drawing projections in the direction of k on the plane π of the spatial object, related to the system of coordinates Oxyz through the points is called axonometry, the viewport is the axonometric plane π of spatial object. Drawing parallel projections of a spatial object by this method is called axonometry.

[101] *Expandable surfaces* – a surface which can be converted into a part of a plane so that any curve lying on this surface becomes a planar curve of the same length. Figuratively speaking, it is a surface that can be spread onto a plane without stretching and cutting the surface. Each

The theory of oblique surfaces – the hyperboloid with one layer[102]. The hyperbolical paraboloid[103]. Helical oblique surfaces.
The theory of non-ruled surfaces of the 2-nd order – the sphere. Rotational surfaces of the second order as collineates of the sphere. Tri-axial surfaces of second order, as objects related with rotational surfaces of second order.
Theories of rotational surfaces and envelopes – constructions of proper and cast shadows and lines of equal lighting on a surface.
And for 10 years it was not changed until **1902/03** and was the following:
In methods of descriptive geometry, polyhedra were included in the programme and the parts of: the theory of curves and surfaces in general and the theory of oblique surfaces, the theory of nonlinear surfaces of the 2nd order, theories of rotational surfaces and envelopes of curves, were combined into one part: warped curves and warped surfaces, which had the same content as in earlier years; besides, warped curves were made obligatory.
And for the next 7 years it was not changed until **1910/11**.

In **1909/10** subject Descriptive geometry was defined as Descriptive geometry A and B where A was for Faculties of: Engineering, Water Engineering and Course of Surveyors. B – for Faculties of: Civil Engineering and Architectures and Constructions Of Machines.

In **1910/11** A was for faculties of: Engineering, Hydro technical, the Course of Surveyors, B – for faculties of: Civil Engineering and Construction of Machines.

In **1911/12** teaching programme was as follows:

Rectangular projections and the cavalry perspective[104]. Rows and unicursal pencils. Conic sections. Relation and geometrical transformation. Polyhedra: sections, penetrating, shadows. Rectangular and sloping axonometry[105]. The central perspective. Warped curves and surfaces. The cone, the cylinder, the sphere;

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expandable surface is a ruled surface (i.e., through each its point there passes a straight line which as a whole lies on the surface), but not always vice versa. Each such surface is either the locus tangent to a spatial curve or a conical surface or a cylindrical surface and, conversely, each of these surfaces is an expandable surface at points of expandable surface lying on the same generating line, the tangent plane is the same.

[102] *Hyperboloid of one layer* – unbounded surface of second degree, coming from rotation of a hyperbole around its imaginary axis, which also can be obtained by rotation of a line around an axis which is skew to it. $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$.

[103] *Hyperbolic paraboloid*, is formed by a parallel translation of a parabola whose vertex slides along a fixed parabola lying in a plane perpendicular to the plane of the moving parabola, but the branches of the parabola are open in the opposite directions.

[104] *Cavalry axonometry* – called a diagonal axonometry, in which the angle $(y^u,z^u)=90^0$ i $j_z=j_y=1$ ($j_z=\frac{0^uZ}{0Z}, j_y=\frac{0^uY}{0Y}$) axonometric viewport is parallel to the plane $0yz$, so axonometry plane figure lying in a plane parallel to the plane $0yz$ is congruent to that figure.

[105] *Diagonal axonometry* – if the projection direction is not perpendicular to the axonometric viewport.

sections, penetration, helical surfaces. Rotational surfaces. The hyperboloid of one layer, the hyperboloidal paraboloid, the conoids. Tubular surfaces. Shadows and lines of equal lighting on surfaces.

This programme was in force up to **1913/14**.

In **1911/12** A – for Faculties of Engineering, Hydro-technical and the Course of Surveyors, B – for the Faculty of Civil Engineering, Constructions of Machines, the Preparatory Course for Candidates for the Mining Profession.

In **1913/14** A – for Faculties of Water Engineering and Civil Engineering. B – for Faculty of the Construction Of Machines and Course of Surveyors, the Preparatory Course for Candidates for the Mining Profession.

THE REPETITORY COURSE OF ELEMENTARY MATHEMATICS

The subject "Repetitory course of elementary mathematics" at Polytechnic School was obligatory since **1892/ 93** and was the following;

The repetitory course of elementary mathematics, particularly the theory of operations and planar and spherical trigonometry.

It was obligatory for the following 5 years, in **1899/00** there was no repetitory course of elementary mathematics, and from **1902/03** until **1905/06** it was replaced by the subject "Exercises in elementary mathematics", in **1905/06** by Exercises in elementary mathematics of the first course. In **1909/10** by Exercises in mathematics I A and B, but the programme was in force from **1902/03** (which concerned only the number of hours in a week) till **1913/14.**

THE REPETITORY COURSE OF HIGHER MATHEMATICS

The subject "repetitory course of higher mathematics" appeared in **1892/93** under the name of "exercises in higher analysis" and was the following:

Analytic functions of one and several independent variables. The element of the function, places infinitely distant, ordinary and singular places. The multivalency of the analytic function. Univalent functions with one and several terminal places.

It was obligatory till **1894/95** when the subject had already the name "repetitory course of higher mathematics: revision and supplement of selected chapters from higher mathematics".

In **1902/03** the subject was named "exercises in higher mathematics" until the year **1904/05**. And in **1905/06** "Exercises in mathematics of the II course", from **1909/10** until the year **1913/14**, "Exercises in mathematics II A and B".

And the programme was the following: revision and supplement of selected chapters of higher mathematics.

PRACTICAL EXERCISES IN CONSTRUCTIONS OF DESCRIPTIVE GEOMETRY

The subject "practical exercises in constructions of descriptive geometry" appeared in **1905/06**, in **1909/10** there was no such subject and from **1911/12** to **1913/14** the

subject was named "exercises in descriptive geometry", the programme referred numbers of hours in a week and was the same all these years.

THE MATHEMATICAL SEMINAR I

The subject "the mathematical seminar I" appeared in **1909/10** and was the following:
Solving and discussing problems in modern analysis, higher geometry and applied mathematics.
It was obligatory without changes until **1913/14**.

ELEMENTS OF HIGHER MATHEMATICS

The subject appeared in teaching programme in **1902/03** and referred:
The development of the concepts of number and space. Rules of planar and spatial analytical geometry with planar and spherical trigonometry. Major curves and surfaces. The concept of function. Differentials and derivatives of functions. The Taylor and Maclaurin series and the calculation of radicals, logarithms and goniometrical functions. Maxima and minima of a function, indeterminate symbols. Geometrical applications of the differential calculus. Rules of the integral calculus. The rectification and complanation of planar curves, complanation and computation of the volume of rotational surfaces.
It was obligatory until the year **1911/12,** when the change concerning the number of hours on week-days was made.

CONTENTS OF MATHEMATICAL SUBJECTS WHICH WERE NOT OBLIGATORY

SYNTHETIC GEOMETRY

5 hours of the lecture weekly, 2 in both semesters, Gustaw Krammer lectured. Practically, the subject of synthetic geometry appeared in **1881/82** and the programme for the next 6 years did not change, and since **1890/91** it was not in the teaching programme. The programme included:
Geometry – images. Compositions. The rule of the duality. The rule of the triplicity. The rule of progression. Planar curves, spherical curves, cylindrical and conical surfaces, and planar curves at infinite distance of the second order. Warped surfaces of the second order. Round surfaces of the second order. Coplotting of systems of points and coplotting of systems of planes. The study of central projections and its applications. Introduction of vividness. The theory of harmony of colours.

THE THEORY OF SUBSTITUTIONS

Every week 3 hours of lecture in the summer semester. Lecturer – doctor Placyd Dziwiński.
The subject "the theory of substitutions" appeared in **1886/87** and in that academic year it was found in reports of the Polytechnic School and included:

General information of substitutions. Circular substitutions. Similar and exchangeable substitutions. System of conjugate substitutions. Simple and complex groups. Special cases of the theory of substitutions. Applications of the theory of substitutions to algebraic equations.

THE THEORY OF DUAL FORMS

3 hours of lectures weekly in the summer semester, the lecturer – doctor Placyd Dziwiński.

The subject "theory of dual forms" appeared in reports in **1886/87** and included: Binary forms, their invariants and covariants. The geometrical explanation of algebraic forms. Resultant and discriminant. Forms of the second, third and fourth order. Systems of forms. Typical forms.

DESCRIPTIVE GEOMETRY BASED ON MODERN GEOMETRY

3 hours of the lecture weekly in both semesters, the lecturer: doctor Mieczysław Łazarski.

The subject "Descriptive geometry based on modern geometry" appeared in **1886/87** and was the following:

Methods of descriptive geometry – central and collinear projections; involution and similarity of planar and spatial systems. Rectangular projections. The projective perspective and axiometry. *The theory* of curves *of the second* order. *The theory of space curves and* expandable surfaces. *Cones, cylinders, the helix and the helical* expandable surface. *The general theory* of *warped, rotational and translational* surfaces. *Particular theory* of surfaces *of second* order.

PARTIAL DIFFERENTIAL EQUATIONS

2 hours of the lecture weekly in the winter semester, the lecturer – doctor Placyd Dziwiński.

The subject "partial differential equations" appeared in **1886/87** and was the following:

The integration of partial differential equations of the first order with two and many independent variables. Singular solutions. Geometrical applications. Partial differential equations of second order with two independent variables. Exercises.

THE CALCULUS OF COMMUTATIVITY

2 hours of the lecture weekly in the winter semester, the lecturer – doctor Placyd Dziwiński.

The subject "the calculus of commutativity" appeared in **1887/88** and lasted only for that year and included:

The theory of maxima and minima, and the calculus of commutativity. Main problems of the calculus of the commutativity. Maxima and minima of single, double and triple integrals.

FOUNDATIONS OF ELLIPTIC FUNCTIONS
2 hours of lecture weekly in the winter semester, the lecturer – doctor Placyd Dziwiński.
The subject "foundations of elliptic functions" appeared in **1888/89** and was the following:
Elliptic integrals and their principal types. Legendre and Jacobi functions. Doubly-periodic functions. Auxiliary elliptic functions. The theory of adding elliptic functions. The problem of multiplication. Transformations of elliptic functions.
Geometrical application. The arc of the ellipse and the hyperbole. Curvature lines on the hyperboloid. The arc of the lemniscate. Curves whose equations depend on elliptic functions.
In 1913/14 this subject was named "Theories of Elliptic Functions" and was the following:
Principal information on the theory of analytic function. Integrals and elliptic functions.

EXAMINATION OF NEW WORKS IN HIGHER ANALYSIS
2 hours of lecture weekly in the winter semester, the lecturer – doctor Placyd Dziwiński.
The subject "examination of new works in higher analysis" appeared in **1890/91** and was the following:
Review, reading and interpretation of the latest works in the domain of higher analysis with special attention to mathematical periodicals found in the library of the Polytechnic School.

THE THEORY OF ANALYTIC FUNCTIONS
2 hours of lecture weekly in the winter semester, the lecturer – doctor Placyd Dziwiński.
The subject "the theory of analytic functions" appeared in programme in **1892/93** and in 1893/94 was named "the theory of functions in complex variables" and was the following:
Analytic functions of one and several independent variables. The element of a function, infinitely distant places, ordinary and singular places. The multi-valuedness of the analytic function. One-valued functions with one and several limiting places.

THE SYNTHETIC THEORY OF WARPED CURVES AND EXPANDED SURFACES
1 hour of lecture a week in the winter semester, the lecturer – dr Mieczysław Łazarski.
The subject "the synthetic theory of warped curves and expandable surfaces" appeared in **1896/97**, **1897/98** concerning only the number of hours in week-days.

SELECTED CHAPTERS OF THE THEORY OF MAPPINGS
1 hour of lecture a week in the winter semester, the lecturer – doctor Placyd Dziwiński.
The subject of "selected chapters of the theory of mappings" appeared in **1898/99** and concerned:
Mappings by means of algebraic functions and their inverses. Irrational relation.

THE MATHEMATICAL SEMINAR II
2 hours of lecture weekly in the winter semester, the lecturer – doctor Zdzisław Krygowski.
The mathematical seminar II appeared in **1898/99** and lasted till **1913/14**, concerning the number of hours on week-days.

THE THEORY OF NUMERICAL EQUATIONS
2 hours of the lecture weekly in the winter semester, the lecturer – doctor Lucyan Böttcher.
The subject "the theory of numerical equations" appeared in **1911/12** and lasted only for that year, its programme was the following:
The most important methods of systematic computation of roots of various algebraic and spatial equations with special attention to technically important problems.
Mathematics was a very important part of education of the future engineers. The programme was oriented not only towards applications, but also emphasized specific learning goals in mathematics.

3.3. Professors and readers of mathematics

Kazimierz Bartel (1882–1941). He was born on March 3, 1882 in Lvov, in the working-class family of Michał and Amelia Chodaczek. In 1901 he graduated from a real gymnasium. In 1902–1907 he studied mechanics at the Lvov Polytechnic School, and in 1908–1909 – mathematics and philosophy at the Lvov University. In 1909, he travelled to Munich for supplemental study. After returning he got his doctorate in 1909 at the Polytechnic School in Lvov on the basis of the work of *O utworach szeregów i pęków inwolucyjnych* [Compositions series and involution pencils] and habilitated in 1912 with the thesis *O płaskich utworach inwolucji stopnia czwartego szeregu zerowego* [On planar products of involution of the fourth series of the zero degree]. After graduating from the Polytechnic School he worked there as an assistant (1907–1911), then Privatdozent of the I Chair of Descriptive Geometry (1911–1912), associate professor (since 1912) and professor of this chair (since 1917), in 1912–1939 he led this chair. In 1930–1931 he was the rector of the Lvov Polytechnic. Another side of his life was his activity as a statesman: the minister of railways (1919–1920),

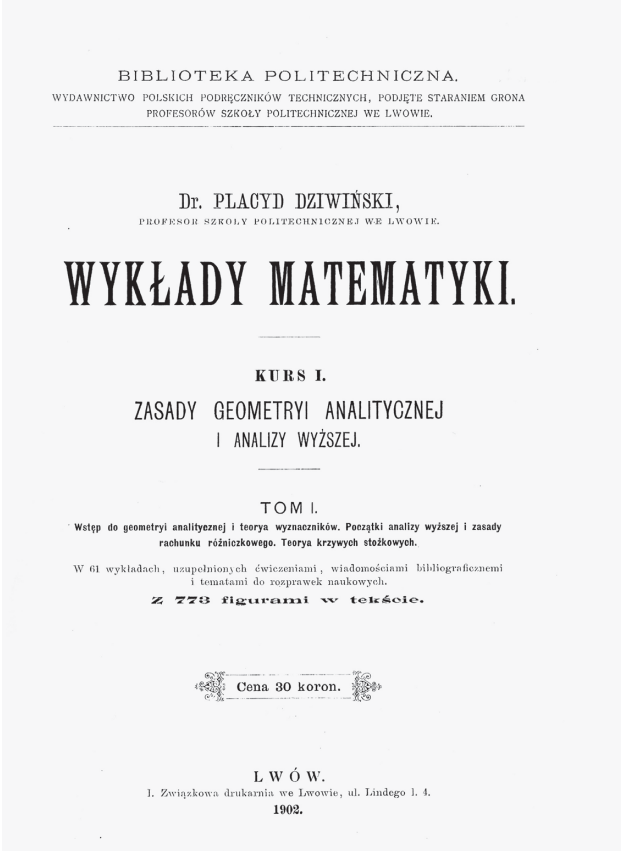
minister of Religious and Public Enlightenment (1926), Member of Parliament (1922–1923) (1928–1929), Prime Minister and Vice Prime Minister (1926–1930), also a senator of Poland (1937–1939). As a determined follower of Piłsudski he led the Labour Party. Despite such an active political life he did not limit his research activities, and only minimally reduced the teaching one He was regarded as an outstanding teacher. He developed a two-volume, many times reprinted textbook *Geometria wykreślna* (1919) [Descriptive geometry]. He was the author of the first and most extensive in the world literature monograph *Perspektywa malarska* (1928) [The perspective of painting], where he also placed a historical overview of the subject (it was also reprinted.) He conducted research in the field of projective geometry and perspective of painting. He was a member of the Scientific Society in Lvov, Warsaw Scientific Society and an active member of the Academy of Technical Sciences. In 1930–1932 he was president of the Polish Mathematical Society. In 1936 he became a doctor honoris causa of the Lvov Polytechnics. Together with a group of Polish professors, he was arrested by the Nazis on July 4, 1941 and executed on July 26, 1941 in Lvov.

Lucyan Böttcher (1872–1937) – his biography is presented in Chapter V.

Wojciech Burtan – assistant of the chair of mathematics in 1901–1906.

Placyd Dziwiński (1851–1936) his birth name was Dziewiński, the mistake occurred during issuing the christening certificate. He graduated from the classical gymnasium in Tarnopol. He studied at the Faculty of Philosophy, the Lvov University and at the same time at the Faculty of Engineering of the Polytechnic School in Lvov. He graduated in 1874; while still a student, he was an assistant at the Department of Geodesy and from 1874 an assistant of the I Chair of Mathematics at the Lvov Polytechnic School. He also taught at the real schools in Lvov and Jarosław. Then he spent a year studying in Berlin and Paris. He founded and for several years ran a weather station in Jarosław. Since 1879 he cooperated with the Physiographic Commission of AS. In 1881, he obtained his doctorate degree and in 1886 he habilitated in mathematics at the Polytechnic School in Lvov. In 1887 he was appointed an associate professor in the II Department of Mathematics, and two years later a professor. He taught mathematics and spherical astronomy, was the head of the Astronomical Observatory. In 1898 he led the I Department of Mathematics and held this position until his retirement in 1925. He never stopped lecturing. He got the title of honorary professor of the Lvov Polytechnic (name Polytechnic School in Lvov since 1921) with the right to lecture. He was the dean of the Faculty of Mechanical Engineering (1888–1889) and the Faculty of Technical Chemistry (1891–1892), rector of the Polytechnic School (1893–1894). In 1889–1894 he edited Czasopismo Techniczne [Technical Magazine]. Since 1899 he was a member of the Lvov City Council.

He published, among others, *Powierzchnię falową Fresnela ze stanowiska geometrycznego* (1878) [The Fresnel wavy surface wave from the geometric standpoint], *Przyczynek do teorii stożków stycznych do powierzchni stopnia drugiego* (1885) [Contribution to the theory of cones tangent to the surface of the second degree]. He was the author of several algebraic works, and repeatedly reprinted textbook *Zasady algebry...* (1891) [Principles of algebra…], commonly used in schools in Galicia. He was interested in the history of mathematics. He also wrote *O algorytmie X. Tomasza Kłosa* (1889) [About the algorithm of Rev. Tomasz Kłos], *Rys działalności naukowej i nauczycielskiej Wawrzyńca Żmurki* (1890) [The outline of scientific and educational activities of Wawrzyniec Żmurko]. The work of his life was a textbook of higher mathematics *Wykłady z matematyki (1902–1908)* [Lectures of Mathematics (1902–1908)]. He died July 13, 1936 in Lvov.



BIBLIOTEKA POLITECHNICZNA.

WYDAWNICTWO POLSKICH PODRĘCZNIKÓW TECHNICZNYCH, PODJĘTE STARANIEM GRONA PROFESORÓW SZKOŁY POLITECHNICZNEJ WE LWOWIE.

Dr. PLACYD DZIWIŃSKI,

PROFESOR SZKOŁY POLITECHNICZNEJ WE LWOWIE.

WYKŁADY MATEMATYKI.

KURS I.

ZASADY GEOMETRYI ANALITYCZNEJ
I ANALIZY WYŻSZEJ.

TOM I.

Wstęp do geometryi analitycznej i teorya wyznaczników. Początki analizy wyższej i zasady rachunku różniczkowego. Teorya krzywych stożkowych.

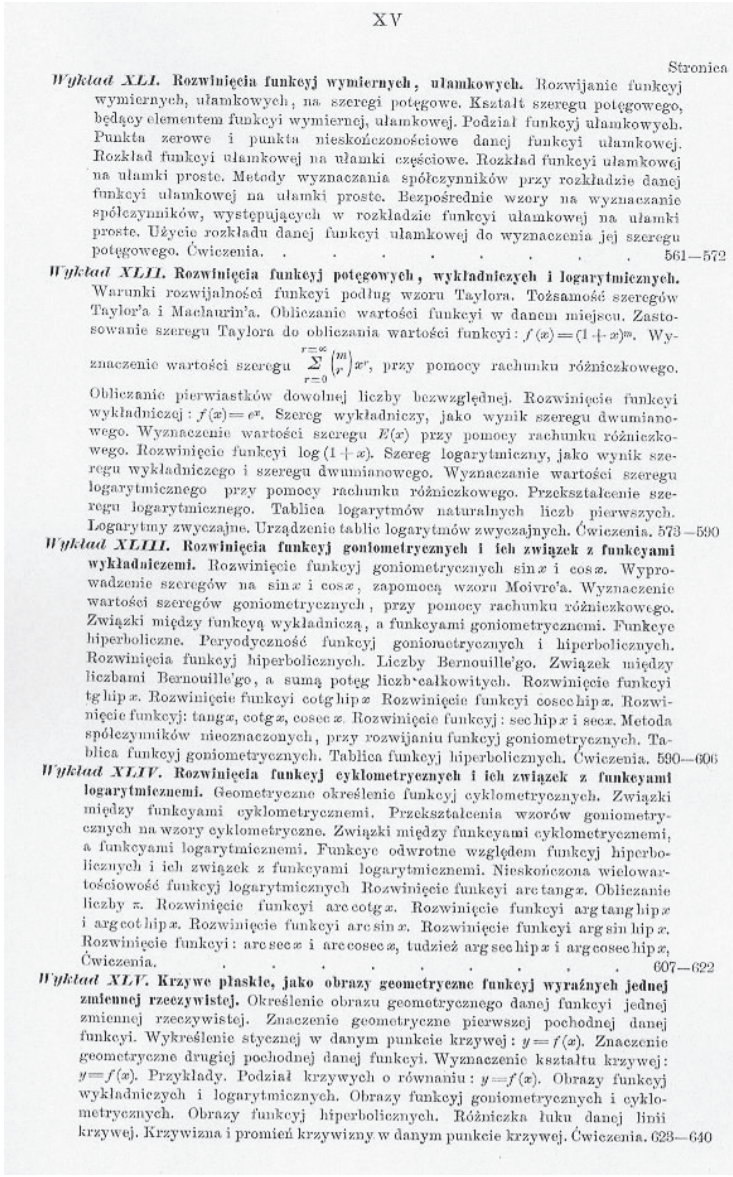
W 61 wykładach, uzupełnionych ćwiczeniami, wiadomościami bibliograficznemi i tematami do rozprawek naukowych.

Z 773 figurami w tekście.

Cena 30 koron.

LWÓW.
I. Związkowa drukarnia we Lwowie, ul. Lindego l. 4.
1902.

Cover page of Dziwiński's *Wykłady matematyki* [Lectures of mathematics]. It appeared in the Library of Polytechnic, this publishing enterprise functioned thanks to the efforts of professorial staff of the Polytechnic School in Lvov.



XV

Fragment of the table of content: *XLI lecture on expansion of rational functions, XLII lecture on expansion of power series, exponential and logarithmic functions, XLIII Lecture on expansion of goniometrical functions and their relation to the exponential functions, XLIV lecture on expansion of cyclometric functions and their relation with logarithmic functions, XLV lecture planar curves as geometric images of explicit functions of one variable*. An extensive work with exercises. We still know too little about it.

Stanisław Kępiński (1867–1908) – he was presented in Chapter II, taught at the University.

Gustaw Krammer – assistant on the Department of General Mechanics, 1872–1873, 1874–1875, in 1881, habilitated at the Polytechnic School in Lvov of the higher geometry in 1881.

Jan Krassowski – constructor of the chair of spherical astronomy and higher geodesy in 1912–1914 and 1916/17.

Zdzisław Krygowski (1872–1955) began his study in the gymnasium in Wadowice, graduated from the III gymnasium named after Sobieski in Cracow, where he passed the school final exam in 1890. In the same year he began studies at the Faculty of Philosophy at the Jagiellonian University. Simultaneously, in 1890–1893 he worked at the Astronomical Observatory. In 1895 in Cracow he passed the examination for a teacher of physics and mathematics, and in November of that year he got a doctoral degree in philosophy with a thesis in the theory of Green's general theorems. In the period 1895–1896 he was on a scholarship in Berlin, where he worked under the guidance of L.T. Fuchs and A.H. Schwarz. During 1896–1898 he worked in Paris (Faculté des Sciences), under the guidance of P. Appell and E. Picard, with whom he was acquainted. After returning home in 1898 he was appointed a deputy of mathematics and physics teacher at the Real School in Cracow. In 1899–1901 he taught in the Gymnasium with Polish language of teaching in Przemyśl. Since 1901 he was a Privatdozent of mathematics at the Faculty of Chemistry and Architecture of the Polytechnic School in Lvov. At the same time he was teacher mathematics and physics at the Real School. In 1906–1907 he went to Paris to prepare a habilitation thesis. He habilitated in 1907 at the Lvov University with the work *Sur le developement des fonctions hyperelliptiques en series trigonometriques* (Prace Matematyczno-Fizyczne, 18(1907)). In 1908 he became an associate professor, and in 1909 a professor of mathematics at the Lvov Polytechnics. In 1917–1918 he was the Rector of the university. After the University of Poznań was created, he was appointed professor in the Department of Mathematics. He organized a seminar on analytic functions, which he directed for 19 years. In 1919–1920 and 1934–1936 he was vice-rector of the Poznań University. In 1938 he retired. During World War II he was expelled by the Nazis and stayed in Cracow. After the liberation he was a professor of the Mining Academy in Cracow. In 1946 he returned to Poznań as a contract professor and taught almost until the last moment of his life. He authored about 30 papers on elliptic and hyper-elliptic functions and their integrals. Besides the papers published in journals he worked out a textbook *Elementy matematyki wyższej* [Elements of higher mathematics (lithographed course)] and *Wykłady z matematyki wyższej*

(cz. *Rachunek różniczkiwy i teoria szeregów*) [Lectures in higher mathematics (part: Differential Calculus and theory of series)], published thanks to the efforts of students of the Lvov Polytechnic. He was interested in music, and so he was a member of the Society named after F. Chopin. He died on 10 August 1955 in Poznań.

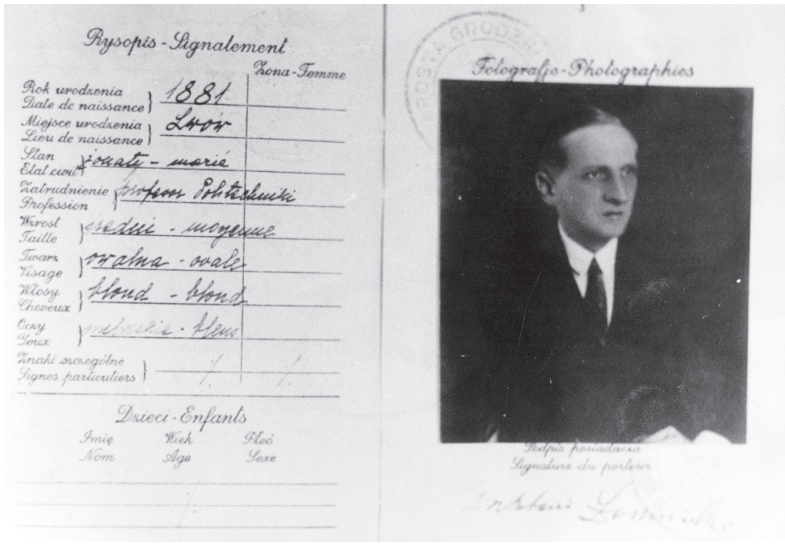
Mieczysław Łazarski (1852–1930) graduated from gymnasium in Cracow, in 1870–1876 he studied at the Faculty of Civil Engineering at the Polytechnic University in Karlsruhe. Then he returned to Galicia and after passing the teacher's exams in mathematics and physics he worked at the Higher Real School in Stanisławów from 1878 to 1885, and in the IV Gymnasium in Lvov in the period 1885–1887. In 1883 he obtained a Doctorate of Philosophy in Mathematics at the Lvov University. In 1885 he habilitated in geometry at the Polytechnics in Lvov. There in 1887 he became an assistant professor of geometry, and a professor in 1889. In 1889 he led the Department of Geometry at the Faculty of Engineering and Architecture. In 1889–1894 he was the dean of the Faculty of Civil Engineering of Polytechnic School, and in 1894/95 academic year – after the change of name into the Faculty of Architecture – he was the first dean. During 1896–1897 he served as the rector of the Polytechnic School. In 1888 –1917 he took part in the examination commission for teachers of secondary schools. Initially, his works were published in the reports of schools where he taught. Together with M. Rembacz he published the textbook *Perspektywa linijna* (1880) [Linear perspective]. Since 1881 he published in *Rozprawach i Sprawozadniach z Posiedzeń Wydziału Matematyczno-Przyrodniczego AU* [Dissertations and Reports of the Meetings of the Faculty of Mathematics and Natural Sciences Academy of Science]. There appeared, among other works: *O konstrukcji linii przecięcia krzywych rzędu drugiego* (1881) [About the construction of the line of intersection of curves of the second order], *O konstrukcji i własnościach krzywych rzędu czwartego z punktem potrójnym* (1886) [On structure and properties of curves of fourth order with triple-point]. In 1889, he published (reprinted many times) a handbook *Zasady geometrii wykreślnej dla użyku wyższych szkół realnych* (t. 1 i 2) [Principles of descriptive geometry for the use of real high schools (Vol. 1 and 2)], a manual of large scientific and teaching value. His pupils and successors were K. Bartel, A. Plamitzer. In 1911 he retired due to loss of eyesight. In 1926 he became honorary professor of the Lvov Polytechnic. He died on 7 May 1930 in Cracow.

Antoni Łomnicki (1881–1941) graduated from gymnasium in Lvov in 1899, then started studying mathematics at the Faculty of Philosophy at the Lvov University. In 1903 he got a doctoral degree of philosophy on the basis of work *O odwzorowaniach cząsteczek funkcji hipergeometrycznych* [On projections of molecules of hyper-geometric functions] and passed an examination qualifying

him to teach mathematics and physics in gymnasia and real schools. From 1903 to1919 he worked as a school teacher in Lvov and Tarnów. Ministerial Scholarship enabled him to continue studies in Göttingen (1906–1907), under the direction of H. Minkowski, D. Hilbert, F. Klein and G. Herglotz. In 1913–1914 academic year he taught as a Privatdozent at the Department of Mechanical Engineering at the Lvov Polytechnic. In 1917–1918 he published two works, one in the area of axiomatics *O układach zasad koniecznych i dostatecznych służacych do definicji pojęcia wielkości* [The systems of necessary and sufficient rules for the definition of the concept of quantity]), the second in the theory of functions of a real variable, *O wielookresowych funkcjach jednoznaczych zmiennej rzeczywistej* [On the univalued explicit functions of real variable]. On the basis of this work he obtained *veniam legendi* at the Polytechnic School in Lvov in 1919. In August 1919 professor Krygowski took a position of deputy professor of mathematics. In 1920 he was appointed an associate professor of mathematics at the Lvov Polytechnic and became the director of the II Department of Mathematics. In 1920 he took part in the Polish-Bolshevik War as a second lieutenant. In 1921 he was appointed professor at the Lvov University. He was three times the dean and in the academic year 1938–1939 vice-rector of Polytechnic University of Lvov. He distinguished himself primarily as an educator and a professor of applied mathematics. The scope of his interests was wide and included analysis, probability, statistics, cartography, and teaching. He introduced the concept of probability based on the set theory and the theory of measure. He was the author of 41 scientific papers and textbooks, for example he authored a popular school textbooks: *Geometria* (1911–1912) ["Geometry"], *Tablice matematyczno-fizyczne* (1926) [Mathematics and Physical Tables] and deserves special attention *Rachunek różniczkowy dla potrzeb rzyrodników i techników* (1935, t. 1, 1936, t. 2 and 3) [Integral and differential calculus for naturalists and technicians (1935, Vol. 1, 1936, Vol 2 and 3)]. He participated actively in the reform of mathematics education, both in the Austrian annexation and in independent Poland. He was a specialist in and expert on mathematical cartography. He published the dissertation *Podstawy matematyczne kartografii* (1905) [Foundations of mathematical cartography], in which he applied the theory of mapping the surface of the sphere on a plane. Further analysis of this issue found its expression in the handbook *Kartografia matematyczna* (1927) [Mathematical Cartography]. Łomnicki introduced a new, accurate method of projection in the work of *Matematyczna analiza projekcji mapy międzyarodwej w skali 1:1000000* (1927) [Mathematical analysis of the international projection maps in scale 1:1000000]. He also presented a simple method of measurement by means of radiogoniometrical signals using nets that he constructed himself. This method was introduced in his work *Projekcje o dwu punktach wyróżnionych* [Projections with two distinguished points]. Thanks to the works in cartography he was appointed an expert in the International Committee of the Air Navigation

(Cina). He was a member of the Warsaw Scientific Society (since 1938). In the early days of German-Soviet war, when the German army entered Lvov, he was arrested by the Gestapo, together with a group of Lvov scientists on July 3, 1941 and executed the next day on the Wuleckie hills in Lvov.
Banach's first job in Lvov was in Łomnicki's chair.

A. Łomnicki in uniform during the Polish – Soviet War.



A. Łomnicki identity document (photo provided by professor's daughter).

Karol Maszkowski (1831–1886), He attended gymnasium in Lvov. During 1848–1852 he studied at the Polytechnical University in Vienna. In 1852–1854 he taught at the Real School in Innsbruck, in 1854–1856 at the Institute of Technology in Cracow, and in 1856–1862 at the High Real School in Lvov. In 1862 he was expelled from school for organizing and participating in patriotic demonstrations. In the same year he began working as a reader of arithmetic, geometry and mechanics at the Agricultural College in Dublany, where he worked until 1867. He participated in the January Uprising. In 1867 he was appointed in the Chair of Descriptive Geometry of the Faculty of Architecture, of Technical Academy in Lvov, a position he held until his death. In 1867 he founded the Polish Pedagogical Society, in 1868–1871 he was its chairman. He was the initiator and editor of the journal of the Society, School. In 1868 he organized the first Galician congress of educators. He was forerunner of the Lvov school of descriptive geometry. He introduced the method of projective perspective in the work *Perspektywa rzutowa jako wynik rzutów prostokątnych na płaszczyzny ukośne względem siebie położone* [The projective perspective as a result of orthogonal projections onto planes oblique to each other]. He worked out a geometry textbook for secondary schools (1875) and translated from German *Siedmiocyfrowe pospolite logarytmy* (1862) [Seven-digit common logarithms]. Among other publications one should mention the work on: the reform of secondary schools (1879), the impact of technology on civilization (1880), and planar curves (1883). Lvov Industrial School and School of Artistic Industry were founded at his initiative. He founded the Craftsmen Society

Gwiazda [Star], was a co-founder of the Lvov Polytechnic Society and its first bulletin, *Dźwignia* [Lever]. He performed on the cello in Lvov, organized the Singing Society *Lute*, which he personally directed. He was the director of the Society of Fine Arts in Lvov and an organizer of popular lectures on art. He died in Lvov.

Antoni Pawłowski (1859–1942), graduated from gymnasium in Chernivtsi. In 1878-1881 he studied mathematics at the University of Czernivtci, then he studied economics at the University of Vienna and at the local academy of International Trade. In 1884–1899 he worked in the secondary education in Chernivtsi. From 1899–1919 he was the director of secondary commercial school in Lvov, he oversaw the vocational education in Lvov. In 1913 he became a reader of insurance mathematics at the Polytechnic School in Lvov which he left in 1922. At his initiative the High School of Foreign Trade in Lvov (later the Academy of International Trade) came into being, and he was its rector. In 1922–1937 he headed there the chair of commercial and political arithmetics. After retiring in 1937 as a professor, he continued lecturing in commercial and political arithmetics as an honourable professor. He was the author of numerous papers on applied and business mathematics. In textbooks, related mainly to the political arithmetic and the merchant accounts, he introduced a number of Polish terms of commercial arithmetics. He died in 1942 in Lvov.

Roman Plamitzer (1889–1954), in 1908–1914 studied at the Faculty of Engineering of Polytechnic School in Lvov and in 1910–1913 at the Department of Philosophy at the Lvov University. In 1913 he passed the exam for a secondary school teacher in mathematics and descriptive geometry. In 1914 he obtained a doctorate degree in technical sciences at the Lvov Polytechnics on the basis of a thesis *Przyczynek do teorii krzywych płaskich i powierzchni* [A Contribution to the theory of flat and curved surfaces]. He habilitated in 1921 on the basis of the work *O inwolucyjnych pękach krzywych płaskich* [The involution clusters of planar curves]. In 1911 he started as a deputy assistant at the Polytechnic School, moved up in the scientific career, in 1922 he became an associate professor, in 1929 – the professor of II Department of Descriptive Geometry at the Faculty of Mechanical Engineering at the Lvov Polytechnics. Since 1945 he co-organized the Silesian Polytechnic University with a temporary residence in Cracow, he was head of the Department of Descriptive Geometry. After moving the Silesian Polytechnic University to Gliwice he remained in Cracow and lectured in the descriptive geometry at the Polytechnic Department of the University of Mining, at the same time he headed the Department of Mathematics and Faculty of Engineering. After creating the Cracow Polytechnic University as an independent institution he headed the Department of Descriptive Geometry at the Faculty of the Water Engineering. He published in Polish and German journals 16 original

scientific papers on descriptive and projective geometry and 6 academic textbooks, including *Geometrię wykreślną* (1959) [Descriptive geometry], *Elementy płaskiej geometrii rzutowej* (1921) [Elements of planar projective geometry], *Aksjonometrię prostokątną* (1925) [Rectangular axionometry], *Elementy geometrii rzutowej* (1927) [Elements of projective geometry], *Geometrię rzutową układów płąskich i powierzchni stopnia drugiego* (1938) [Geometry of projective systems and flat surfaces of second degree], *Wykłady geometrii rzutowej* (1946, litografia) [Lectures in projective geometry (lithograph)]. He was interested in historical literature, classical music and painting (he painted in his youth). He died on 15 October 1954 in Cracow.

Franciszek Ulkowski, assistant at the Department of Mathematics in 1906–1910, a teacher at the Real School in Lvov (1910–1911), teacher of mathematics and physics in the c.k. State Industrial School in Cracow (1912–1913). In 1905 he was a student of the Polytechnic School in Lvov, published a two-part article *O nomografii w Czasopiśmie Technicznym* [On nomography in the Technical Journal].

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CZASOPISMO TECHNICZNE

ORGAN
TOWARZYSTWA POLITECHNICZNEGO
we Lwowie.

Ogólnego zbioru rocznik XXIX.
Wychodzi dnia 10 i 25 każdego miesiąca.

Cover page of Technical Journal

Prawdopodobnie tak, jak geometrya wykreślna stała się potocznym językiem techników przy opisie konstrukcyi, jak statyka wykreślna staje się coraz doskonalszym środkiem opisu i obliczania sił działających, tak nomografia stanie się potocznym językiem formuł, służących do ich obliczenia.

Franciszek Ulkowski,
słuchacz Szkoły politechn.

In the presented passage he wrote: *Probably, as descriptive geometry has become the common language of technicians when decribing constructions, as descriptive static is becoming a more and more perfect means to describe and calculate forces, so nomography will become a common language of formulas, as a way of calculating them*.

Władysław Zajączkowski (1837–1898), taught at the University of Lvov. More widely in Chapter II.

Wawrzyniec Żmurko (1824–1889) was presented in the II Chapter.

Kazimierz Żorawski (1866–1953) was born on June 22, 1866 in Szczurzyn near Ciechanów in the family of Juliusz and Kazimiera Kaminski. After finishing IV Gymnasium in Warsaw, he studied philosophy and mathematics at the Imperial University of Warsaw. In 1888 he obtained the degree of candidate of mathematical sciences with a thesis in astronomy. In 1891, he got his Ph.D. at the University of Leipzig on the work *O pewnym odkształceniu powierzchni* (Rozprawy AU, Wydział Matematyczno-Przyrodniczy, 23(1891)) [On a deformable surface (AU Dissertations, Faculty of Mathematics and Natural Sciences, 23/1891)]. In 1892 he habilitated at the Polytechnic School in Lvov, where in 1892 he began working as a Privatdozent of the Department of Theoretical Mechanics. In 1893–1895 he was assistant professor at the Jagiellonian University. In 1895 he became an associate professor, and in 1898 a professor of the University. Prof. S. Zaremba was acquired from France in 1900 thanks to Żorawski. S. Zaremba with Żorawski (1866–1953) created a research center of Cracow, which in the next years boasted of the excellence success of scientific schools: Tadeusz Ważewski in differential equations (1896–1972), complex analysis of Franciszek Leja (1855–1979), Antoni Hoborski (1879–1940) and Stanisław Gołąb (1902–1980) in geometry.
He remained in the first Department of Mathematics of Jagiellonian University until 1919. In 1905–1906 he was the Dean of the Faculty of Mathematics and Natural Sciences, in 1917–1918 – the rector of the Jagiellonian University. In 1919 he moved to Warsaw, where he became a professor at the Warsaw Polytechnic University. Since 1920–1921 he was a Director of the Department of Science and Higher Education of Ministry of Religious Affairs and Public Education. Since 1900 he was a corresponding member of AS, and since 1916 – an active member of the SAS and the AS, and since 1952 the titular member of State Academy of Sciences. Since 1920 he belonged to the Warsaw Scientific Society, in 1925-1931 he was its chairman. Topics of Żorawski scientific works included differential equations, differential geometry and mathematical physics problems, the theory of differential and integral invariants. He was the author of two volumes *Wykładu geometrii analitycznej* (1930, t. 1; 1934, t. 2) [Lecture of analytic geometry (1930, Vol 1, 1934, Vol 2)], where as the first in Polish literature he presented the interpretation of vectors, straight lines and circles on the Gauss plane. The results and formulas obtained by him in 1902 were published in the work *O własnościach pewnej całki wielkokrotnej, będących uogólnieniem dwóch twierdzeń z teorii wirów* [On the properties of multiple integrals], and are a generalization of two theorems in the theory

of vortices, unfortunately only in Polish; they were re-discovered again by E. Goursat in 1908. He published about 50 papers on topological groups, differential forms and mathematical physics. A. Hoborski continued his work in differential geometry and the Lie group theory. He died on January 23, 1953 in Warsaw.