University of Belgrade - Faculty of Chemistry

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THE DEVELOPMENT STRATEGY OF THE FACULTY OF CHEMISTRY

Belgrade, January 2013

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C O N T E N T S

1 THE STRATEGY

Due to the results achieved in the field of science and education, the Faculty of Chemistry holds a leading position as the most eminent and benchmark academic institution in the field of chemical sciences in Serbia. Since it is present in every aspect of everyday life, chemistry makes a major contribution to building a better future and well-being of Serbian citizens, which is the primary, global and strategic goal of the Faculty of Chemistry and the institutions which it has founded (the Center for Chemistry of the Institute for Chemistry, Technology and Metallurgy (ICTM) and the Innovation Center of the Faculty of Chemistry). By educating chemists of various profiles at all levels and due to the results of its scientific work, the Faculty has a decisive influence in creating and realizing all chemistry-related contents in Serbia.

The primary goal of the Faculty of Chemistry, which is one of five faculties in Serbia at which chemistry and chemistry-related disciplines are studied, is providing high-quality education at all levels of studies (undergraduate, master and doctoral studies) and developing various competencies which young people need to acquire in order to work in a chemical laboratory or as chemistry teachers.

The Faculty will keep aspiring to have the most distinguished experts on its staff in all specialized scientific fields which are studied at our Faculty, while younger generations will be required to continually assess and improve their professional competencies. Maintaining and developing interdisciplinary cooperation in the country and abroad with the appropriate support of technical and administrative infrastructure of the Faculty remains the permanent priority of our educational institution.

In order to make the development strategy of the Faculty of Chemistry realistic and the text of the strategy concise and based on actual facts, we will elaborate on all elements of the strategy following the principles of objective analysis of the results achieved so far and the projection of the Faculty development which is inextricably linked with the previous results of our work.

This strategy is developed for the period of up to five years.

The strategy document contains the following key elements:

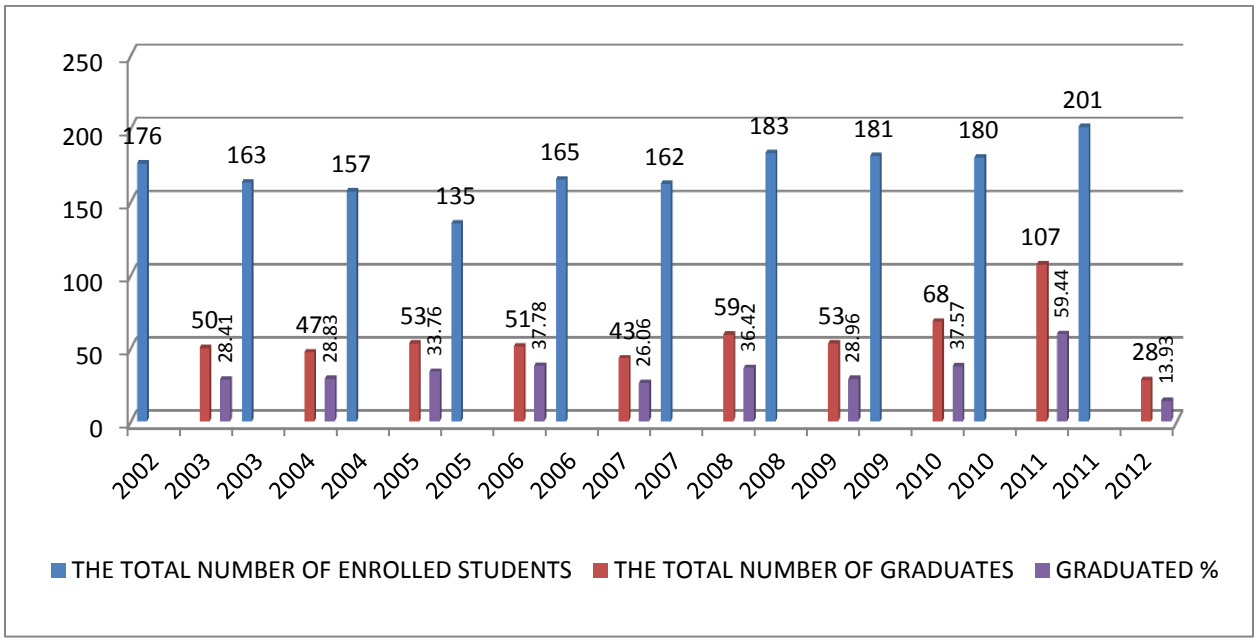
A. The analysis of the existing indicators of achievement: students, enrolment and the results students have achieved, projects and results of scientific and research work, and the Faculty's finances,
B. The development strategy for educational process and its evaluation,
C. Personnel policy at the Faculty, and
D. The promotion of the Faculty.

Each of the above-mentioned elements will be described and explained in detail.

2 STUDIES – STUDENT ENROLMENT TRENDS, STUDENTS' RESULTS AND THE NUMBER OF GRADUATES AT THE FACULTY OF CHEMISTRY

Chemistry studies have always been classified into the group of harder study programs in the field of natural sciences at the University of Belgrade. Chemistry is a natural science with a hidden logic which can be studied by the ones who are interested in laboratory work and who want to understand the basic natural principles on which the entire universe and the world around us are based.

Chemistry studies are organized at several universities in our country, but the Faculty of Chemistry, the University of Belgrade, has the largest number of enrolled students. The enrolment dynamics in the last decade are shown in picture 2.1.



Picture 2.1. The dynamics of student enrolment (state-financed and self-financed) on the undergraduate studies in the last decade

2.1 THE QUALITY OF FUTURE STUDENTS' KNOWLEDGE

The grade point average (GPA) of candidates who come to take the entrance exam is different every year, but, generally speaking, it can be characterized as very good. On average, slightly less than 50% of the total number of enrolled students are excellent pupils (10% of enrolled students had all excellent marks), while slightly more than 35% of them were very good pupils. The distribution of high school achievement of the candidates enrolled at the Faculty of Chemistry from 2009 to the present day is shown in Table 2.1.

Table 2.1. High school achievement and the result achieved at the chemistry entrance exam

The school year: 2009/2010		
High school achievement		
Mark	**Number**	**Share (%)**
= 5	21	14.38
>= 4.5	62	42.47
>= 3.5	52	35.62
>= 2.5	11	7.53
Others:	0	0.00
Total:	**146**	**100**
The results achieved in the chemistry entrance exam		
Points	**Number**	**Share (%)**
= 60	19	13.01
>= 50	39	26.71
>= 40	36	24.66
>= 30	32	21.92
>= 20	19	13.01
Others:	1	0.68
Total:	**146**	**100**

The school year: 2010/2011		
High school achievement		
Mark	**Number**	**Share (%)**
= 5	18	11.92
>= 4.5	55	36.42
>= 3.5	56	37.09
>= 2.5	21	13.91
Others:	1	0.66
Total:	**151**	**100**
The results achieved in the chemistry entrance exam		
Points	**Number**	**Share (%)**
= 60	9	5.96
>= 50	56	37.09
>= 40	42	27.81
>= 30	29	19.21
>= 20	10	6.62
Others:	5	3.31
Total:	**151**	**100**

Table 2.1. (continued) High school achievement and the result achieved at the chemistry entrance exam

The school year: 2011/2012		
High school achievement		
Mark	**Number**	**Share (%)**
= 5	17	9.94
>= 4.5	69	40.35
>= 3.5	73	42.69
>= 2.5	12	7.02
Others:	0	0.00
Total:	**171**	**100**
The results achieved in the chemistry entrance exam		
Points	**Number**	**Share (%)**
= 60	18	10.53
>= 50	52	30.41
>= 40	33	19.30
>= 30	39	22.81
>= 20	27	15.79
Others:	2	1.17
Total:	**171**	**100**

The school year: 2012/2013		
High school achievement		
Mark	**Number**	**Share (%)**
= 5	26	13.20
>= 4.5	75	38.07
>= 3.5	78	39.59
>= 2.5	18	9.14
Others:	0	0.00
Total:	**197**	**100**
The results achieved in the chemistry entrance exam		
Points	**Number**	**Share (%)**
= 60	14	7.11
>= 50	63	31.98
>= 40	66	33.50
>= 30	40	20.30
>= 20	13	6.60
Others:	1	0.51
Total:	**197**	**100**

The results which the candidates who have been enrolled at the Faculty of Chemistry from the year 2009 to the present day have achieved in the chemistry entrance exam can also be seen in the table above. The results are given by points gained in the exam. The largest number of students enrolled on chemistry study programs gain slightly more than 40 points on average (out of a maximum of 60 points).

The lesson plans and syllabi of the Faculty of Chemistry were harmonized with the Bologna Process in 2005. Pursuant to the decision number 119-01-68/2008-04 from April 12th 2008 made by the Committee for Accreditation and Quality Control of the Republic of Serbia, the following accredited study programs are organized at the Faculty:

- Undergraduate academic studies: Chemist, Biochemist, Environmental Chemist, Chemistry Teacher;
- Master academic studies: Graduate Chemist - Master, Graduate Biochemist - Master;
- Doctoral academic studies: PhD in Chemical Sciences, PhD in Biochemical Sciences.

There are four study programs of four-year-long undergraduate academic studies at the Faculty:

- Study program Chemist (31 exams altogether including the final thesis)

- Study program Biochemist (31 exams altogether including the final thesis)
- Study program Chemistry Teacher (35 exams altogether including the final thesis)
- Study program Environmental Chemist (31 exams altogether including the final thesis).

2.2 ENROLMENT DYNAMICS

Enrolment dynamics are a particularly important indicator of the popularity of the Faculty of Chemistry. The data which we have and which are appropriate for the type of analysis which will be conducted here are for the period from the year 2002 to the middle of this year (the year 2012). The number of enrolled students and the number of graduates (also given in percent) regardless of the length of studies have been chosen as the most general indicators. Enrolment dynamics by study groups are shown in Table 2.2.

Table 2.2. Enrolment dynamics of the undergraduate academic studies given by study programs

UNDERGRADUATE STUDIES	2002	2003	2003	2004	2004	2005	2005	2006
	Enrolled	Graduated	Enrolled	Graduated	Enrolled	Graduated	Enrolled	Graduated
CHEMISTRY	108	30	105	27	86	31	76	33
BIOCHEMISTRY	45	19	44	15	40	19	40	15
CHEM. TEACHER	23	1	14	5	17	3	13	3
EN. CHEMISTRY	0	0	0	0	14	0	6	0
TOTAL	176	50	163	47	157	53	135	51
Graduated (%)		28.41		28.83		33.76		37.78

Table 2.2. (continued) Enrolment dynamics of the undergraduate academic studies given by study programs

UNDERGRADUATE STUDIES	2006	2007	2007	2008	2008	2009	2009	2010
	Enrolled	Graduated	Enrolled	Graduated	Enrolled	Graduated	Enrolled	Graduated
CHEMISTRY	80	31	84	31	80	26	82	25
BIOCHEMISTRY	47	5	41	21	43	23	44	28
CHEM. TEACHER	22	7	11	5	24	3	25	7
EN. CHEMISTRY	16	0	26	2	36	1	30	8
TOTAL	165	43	162	59	183	53	181	68
Graduated (%)		26.06		36.42		28.96		37.57

Table 2.2. (continued) Enrolment dynamics of the undergraduate academic studies given by study programs

UNDERGRADUATE STUDIES	2010	2011	2011	2012	TOTAL	TOTAL
	Enrolled	Graduated	Enrolled	Graduated	Enrolled	Graduated
CHEMISTRY	83	68	87	17	871	319
BIOCHEMISTRY	44	23	52	3	440	171
CHEM. TEACHER	22	4	25	6	196	44
EN. CHEMISTRY	31	12	37	2	196	25
TOTAL	180	107	201	28	1703	559
Graduated (%)		59.44		13.93		32.82

2.3 ANALYSIS OF STUDENTS' SUCCESS IN EXAMS

There are 110 courses for students of undergraduate academic studies, 73 of which are compulsory and 37 of which are elective. The names of courses and the percent of students who have passed the exam in the period of the last three years are given in Table 2.3.

Table 2.3. The list of courses (the elective ones are marked with E), the corresponding number of ECTS credits and the average number of students who have passed the exam in percent for the school years 2009/10, 2010/11 and 2011/12 at the undergraduate academic level

Undergraduate academic studies					**Average**
Ord no.	**Code**	**Elective or compulsory**	**Course name**	**ECTS credits**	**NSPE[1] (%)**
1	1314H	E	Analysis of Real Samples	8	94.44
2	1301A		Analytical Chemistry 1	9	48.70
3	1301B		Analytical Chemistry 1	6	41.29
4	1301H		Analytical Chemistry 1	11	68.66
5	1302B		Analytical Chemistry 2	8	65.53
6	1302H		Analytical Chemistry 2	10	39.32
7	1302P		Analytical Chemistry 2	10	62.60
8	1302S		Analytical Chemistry 2	10	67.74
9	1303H		Analytical Chemistry 3	9	41.43
10	1391B	E	Bioanalytical Chemistry	6	68.15
11	1523S	E	Bioindicators	10	94.66
12	1061B		Cell Biology	9	47.67
13	1191B	E	Bioinorganic Chemistry	6	92.64
14	1294B	E	Bioorganic Chemistry	6	16.67
15	1491S		Environmental Biotechnologies	7	89.00
16	1431B	E	Biotechnological and Industrial Biochemistry	6	86.18
17	1409A		Biochemistry	7	46.35
18	1409H		Biochemistry	6	37.80
19	1402B		Biochemistry of Metabolism	6	46.97

[1] The number of students who have passed the exam.

Undergraduate academic studies					Average
Ord no.	**Code**	**Elective or compulsory**	**Course name**	**ECTS credits**	**NSPE[1] (%)**
20	1401B		Biochemistry of Proteins and Nucleic Acids	12	70.36
21	1422B		Methods in Biochemistry	10	46.72
22	1512S		Geochemistry and Soil Pollutants	7	73.33
23	1051S	E+C	Ecology	4	67.82
24	1031A		English Language	3	55.63
25	1421B		Enzymology	7	39.51
26	1514S		Food Contaminants	9	73.33
27	1321H		Elective course D	4	71.56
28	1424B		Immunochemistry	7	98.15
29	1501A		Industrial Chemistry	7	41.69
30	1501S		Industrial Chemistry – the Best Available Techniques	8	53.51
31	1303A		Instrumental Analytical Chemistry	8	67.06
32	1611P		History of Chemistry	2	40.35
33	1001A		Mathematics	9	57.80
34	1052S		Meteorology	2	64.47
35	1312A	E	Separation Methods	6	88.31
36	1432B	E	Methods in Clinical Chemistry	6	66.67
37	1601P		Methodology of Chemistry Teaching 1	4	65.64
38	1602P		Methodology of Chemistry Teaching 2	3	93.33
39	1603P		Methodology of Chemistry Teaching 3	6	79.72
40	1604P		Methodology in Chemistry Teaching 4	5	78.89
41	1434B	E	Mechanisms of Action of Physiologically Active Substances	6	89.44
42	1133H	E	Inorganic Reaction Mechanisms	8	61.67
43	1065B		Microbiology	5	81.87
44	1423B		Microbiological Chemistry and Basic Biotechnology	11	90.09
45	1053S		Atmospheric Pollution Modelling	4	96.97
46	1064B		Molecular Genetics	7	56.17
47	1102A		Inorganic Chemistry	10	52.99
48	1102B		Inorganic Chemistry	6	40.67
49	1102S		Inorganic Chemistry	10	28.82
50	1103H		Inorganic Chemistry 2	10	79.03
51	1103P		Inorganic Chemistry 2	7	79.39
52	1521S	E	Inorganic Pollutants	10	71.53
53	1233A	E	Chemical Nomenclature	4	38.89
54	1311A	E	Measurement Data Processing	4	63.16
55	1002A	E	Selected Chapters of Mathematics	4	25.00
56	1012A	E	Selected Chapters of Physics	4	52.99
57	1349A	E	Selected Areas of Analytical Chemistry	10	62.17
58	1149A	E	Selected Areas of Inorganic Chemistry	10	75.00
59	1249A	E	Selected Areas of Organic Chemistry	10	41.53
60	1549A	E	Selected Areas of Applied Chemistry	10	51.86
61	1101A		General Chemistry	12	57.10
62	1201A		Organic Chemistry 1	10	60.42
63	1201B		Organic Chemistry 1	11	40.03

Undergraduate academic studies					Average
Ord no.	**Code**	**Elective or compulsory**	**Course name**	**ECTS credits**	**NSPE[1] (%)**
64	1202A		Organic Chemistry 2	10	51.39
65	1202B		Organic Chemistry 2	10	66.00
66	1203B	E	Organic Chemistry 3	6	83.34
67	1203P		Organic Chemistry 3	10	77.97
68	1203S		Organic Chemistry 3	3	83.43
69	1211H		Organic Synthesis 1	7	57.48
70	1212H		Organic Synthesis 2	9	42.41
71	1522S	E	Organic Pollutants	10	90.00
72	1131A	E	Fundamentals of Geometric Crystallography	4	91.75
73	1121A	E	Fundamentals of Coordination Chemistry	4	84.21
74	1062B		Fundamentals of Molecular Biology	6	67.33
75	1235H	E	Basic Molecular Modelling and Cheminformatics	8	65.91
76	1111H		Basic Use of Computers in Chemistry	2	73.61
77	1236A	E	Fundamentals of Supramolecular Chemistry and Nanochemistry	10	66.67
78	1019B	E	Fundamentals of Physics	4	88.10
79	1511S		Basic Atmospheric Chemistry and Air Pollutants	6	52.78
80	1425B		Pathobiochemistry	8	79.17
81	1043P		Pedagogy	4	67.22
82	1621P	E	Application of Computers in Chemistry Teaching	4	100.00
83	1234A	E	Applied Organic Chemistry	6	65.07
84	1524S	E	Natural Resources	10	100.00
85	1042P	E+C	Psychology	4	65.62
86	1112H		Computational Chemistry	7	92.63
87	1403B		Regulation of Biochemical Processes	5	51.35
88	1313H	E	Modern Instrumental Methods in Analytical Chemistry	8	74.62
89	1232H		Stereochemistry	5	43.77
90	1221A		Structural Instrumental Methods	11	54.88
91	1221B		Structural Instrumental Methods	7	32.97
92	1221P		Structural Instrumental Methods	5	49.47
93	1231H		Theory of Chemical Bonding	7	96.17
94	1433B	E	Toxicological Biochemistry	6	66.67
95	1054S	E	Quality Management and Legislation	4	82.64
96	1011A		Physics	9	46.81
97	1063B		Physiology	7	26.59
98	1029B		Physical Chemistry	8	58.10
99	1021A		Physical Chemistry 1	7	61.31
100	1022A		Physical Chemistry 2	7	62.05
101	1041P	E	Philosophy of Natural Sciences	4	42.12
102	1132A	E	Chemistry of Bioelements	6	92.12
103	1513S		Chemistry of Water and Wastewater	10	83.18
104	1505H		Environmental Chemistry	3	81.17
105	1505P		Environmental Chemistry	5	88.78
106	1055H	E	Chemistry of Macromolecules	8	64.55
107	1411A		Chemistry of Natural Products	7	40.27

Undergraduate academic studies					Average
Ord no.	Code	Elective or compulsory	Course name	ECTS credits	NSPE[1] (%)
108	1411B		Chemistry of Natural Products	12	47.10
109	1515S		Chemodynamics of Pollutants	7	95.67
110	1291P		School Experiments in Chemistry Teaching	8	77.78

On undergraduate academic studies, the average number of students who have passed the final exam is 65.26% for all courses for these three years.

Apart from the undergraduate academic studies, yearlong master academic studies are organized at the Faculty of Chemistry through the following study programs:

- **Master academic studies in Chemistry** (4 exams altogether including the final thesis) which are organized in the following scientific areas: analytical chemistry, general and inorganic chemistry, organic chemistry, applied chemistry, environmental chemistry and chemistry teaching
- **Master academic studies in Biochemistry** (5 exams altogether including the final thesis) which are organized in the field of biochemistry.

Enrolment dynamics by study programs are shown in Table 2.4.

Table 2.4. Enrolment dynamics for master academic studies by study programs

MASTER STUDIES	2009	2010	2010	2011	2011	2012	TOTAL	TOTAL
	Enrolled	Completed	Enrolled	Completed	Enrolled	Completed	Enrolled	Completed
CHEMISTRY	16	17	41	25	50	10	107	52
BIOCHEMISTRY	3	5	3	11	12	3	18	19
TOTAL	19	22	44	36	62	13	125	71
Completed (%)		115.79		81.82		20.97		56.80

There are 23 courses altogether on master academic studies, two of which are compulsory courses and 21 of which are elective courses. The names of courses and the number of students who have passed the final exam in the period of last three years are shown in Table 2.5.

Table 2.5. The list of courses (the elective ones are marked with E), the corresponding number of ECTS credits and the average number of students who have passed the exam for each course for the school years 2009/10, 2010/11 and 2011/12 on master academic studies

Master academic studies					Average
Ord. no.	Code	Elective	Course name	ECTS credits	NSPE (%)
1	2451B		Bioinformatics	4	95.21
2	2152H	E	Bioinorganic Chemistry	8	100.00
3	2251H	E	Bioorganic Chemistry	8	55.00
4	2453B	E	Biochemistry and Biophysics of Macromolecules	4	70.00
5	2066B	E	Biochemistry and Physiology of Plants	4	97.78
6	2222B	E	Advanced Course in Structural Instrumental Methods	4	72.22
7	2067B	E	Immunobiology	4	91.67
8	2612H	E	History of Chemistry 2	8	67.46
9	2651H	E	Researches in Chemistry Teaching	9	44.05
10	2253H	E	Conformational Analysis	8	95.46
11	2122H	E	Coordination Chemistry	8	94.45
12	2552H	E	Environmental Monitoring	8	36.67
13	2351H	E	Selected Methods of Instrumental Analysis	9	72.50
14	2551H	E	Organic Geochemistry and Petroleum Pollutants	9	55.91
15	2452B		Modern Biochemical Methods	8	90.08
16	2225H	E	Modern Structural Methods	8	62.28
17	2652H	E	Modern Methods in Chemistry Teaching	8	60.39
18	2213H	E	Synthesis of Complex Organic Molecules	9	85.00
19	2353H	E	Statistical Data Processing in Analytical Chemistry	8	75.52
20	2492H	E	Toxicological Chemistry	8	39.17
21	2252H	E	Physical Organic Chemistry	8	66.67
22	2151H	E	Solid State Chemistry	9	94.45
23	2352H	E	Chromatographic Methods	8	65.77

On master academic studies, the average number of students who have passed the final exam is 73.38% for all courses for these three years.

After completing master academic studies at the Faculty of Chemistry, a student can enroll on three-year-long doctoral academic studies in the following study programs:

- **Study program of doctoral academic studies in chemistry** (7 exams altogether including the dissertation defense) which are organized in the following scientific fields: analytical chemistry, general and inorganic chemistry, organic chemistry, applied chemistry, environmental chemistry and chemistry teaching.

- **Study program of doctoral academic studies in biochemistry** (7 exams altogether including the dissertation defense) which are organized in the scientific field of biochemistry.

Enrolment dynamics by study programs for doctoral academic studies are shown in Table 2.6.

Table 2.6. Enrolment dynamics for doctoral studies given by study programs

DOCTORAL STUDIES	2009	2010	2010	2011	2011	2012	TOTAL	TOTAL
	Enrolled	Completed	Enrolled	Completed	Enrolled	Completed	Enrolled	Completed
CHEMISTRY	16	0	34	0	31	1	81	1
BIOCHEMISTRY	4	0	21	0	21	1	46	1
TOTAL	20	0	55	0	52	2	127	2
Completed (%)		0.00		0.00		3.85		1.57

There are 39 courses altogether on doctoral studies. All courses on doctoral studies are elective. The names of courses and the number of candidates who have passed the exam in the period of the last three years are given in Table 2.7.

Table 2.7. The list of courses (the elective ones marked with E), the corresponding number of ECTS credits and the average number of candidates who have passed the exam for each course in the school years 2009/10, 2010/11 and 2011/12 on doctoral academic studies

Doctoral academic studies					**Average**
Ord. no.	**Code**	**Elective**	**Course name**	**ECTS credits**	**NSPE** (%)
1	3374H	E	Bioanalytical Chemistry	5	68.89
2	3480B	E	Biochemistry of Food and Nutrition	5	63.33
3	3571H	E	Fuels	5	75.56
4	3293B	E	Design and Development of New Drugs	5	50.00
5	3477B	E	Ecological Biochemistry	5	50.00
6	3613H	E	History of Science and Teaching in Serbia	5	55.56
7	3171A	E	Metals and Metal Complexes in Medicine	5	66.67
8	3173H	E	Methods of Conformational Analysis	5	33.33
9	3671H	E	Methodology of Pedagogic Research in Chemistry Teaching	5	44.44
10	3175H	E	Inorganic Syntheses	5	52.38
11	3071H	E	Inorganic Materials	5	78.41
12	3272H	E	New Synthetic Methods	5	23.33
13	3479B	E	Selected Chapters of Biotechnology	5	55.95
14	3068B	E	Selected Chapters of Plant Biochemistry	5	57.50
15	3472B	E	Selected Chapters of Biochemistry of Macromolecules	5	–
16	3482B	E	Selected Chapters of Biochemistry of Microorganisms	5	72.22
17	3478B	E	Selected Chapters of Experimental Biochemistry	5	8.34
18	3473B	E	Selected Chapters of Enzymology	5	0.00
19	3475B	E	Selected Chapters of Immunochemistry	5	66.67
20	3483B	E	Selected Chapters of Microbiological Transformations	5	50.00
21	3474B	E	Selected Chapters of Pathobiochemistry	5	63.33
22	3476B	E	Selected Chapters of Toxicological Biochemistry	5	30.95
23	3471B	E	Selected Chapters of Chemistry of Natural Products	5	50.00
24	3224B	E	Selected Chapters of Structural Instrumental Methods	5	37.50

Doctoral academic studies					Average
Ord. no.	**Code**	**Elective**	**Course name**	**ECTS credits**	**NSPE** (%)
25	3771H	E	Organometallic Chemistry	5	50.00
26	3045H	E	Educational Psychology	5	66.67
27	3044H	E	Developmental Psychology	5	66.67
28	3372H	E	Modern Instrumental Methods	5	54.29
29	3226H	E	Modern Structural Methods 2	5	47.41
30	3373H	E	Modern Chromatographic Methods	5	61.11
31	3375H	E	Sensors	5	84.92
32	3056H	E	Synthesis and Characterization of Polymers	5	16.67
33	3273H	E	Free Radical Reactions	5	–
34	3481B	E	Free Radical Processes in Biochemistry	5	72.22
35	3172H	E	Spectroscopic Methods in Inorganic Chemistry	5	75.93
36	3484B	E	Stabilization of Biocatalysts and their Application in Non-Aqueous Media	5	–
37	3271H	E	Structure and Biological Activity of Organic Compounds	5	25.00
38	3274H	E	Chemistry of Secondary Metabolites	5	20.00
39	3371H	E	Chemometrics	5	71.21

On doctoral academic studies, the average number of students who have passed the final exam is 47.86% for all courses for these three years.

The number of candidates who have completed their doctoral studies is small (Table 2.6) since the Faculty of Chemistry has only recently introduced doctoral studies harmonized with the Bologna Process and since these studies last from 3 years (minimum) to 6 years (maximum).

In the period from 1946, since when the record has been kept, to the present day (September 5th 2012), 3701 students have completed their undergraduate academic studies, 586 students have completed their master studies (old master program), 139 students have completed their specialized studies, 142 students have completed their master studies and 417 candidates have completed their doctoral studies at the Faculty of Chemistry.

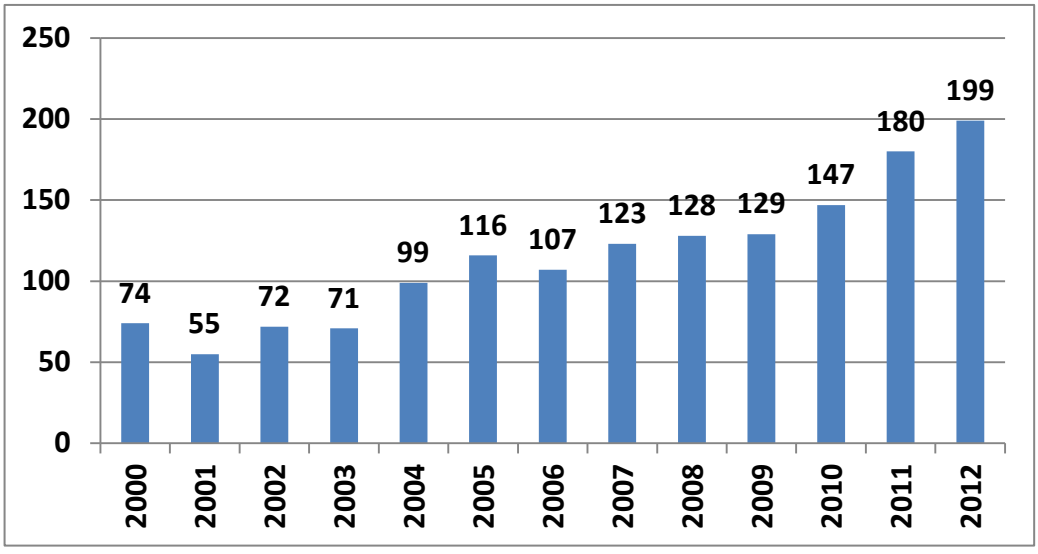
The main strategic goal of the Faculty of Chemistry is to keep the present number of students enrolled on undergraduate studies, to consider the possibility of increasing that number and the number of students who get their master's degree and to keep the same dynamics of acquiring PhDs in chemical sciences without lowering criteria while keeping the reputation of a prestigious faculty where students acquire diplomas which are recognized worldwide without any additional exams and terms.

3 PUBLICATIONS IN INTERNATIONAL JOURNALS AND PROJECTS OF THE FACULTY OF CHEMISTRY, THE UNIVERSITY OF BELGRADE

The Faculty of Chemistry performs its scientific activity as an equally important area of its entire activity. Scientific work is conducted through basic, applied, and developmental research with the aim of developing science and profession, improving the quality of teaching, scientific and professional development, educating young scientists and teachers, introducing students to scientific work and creating material conditions for the work and development of the Faculty.

3.1 PUBLICATIONS FROM THE SCI LIST

The Faculty of Chemistry (FC), the University of Belgrade, has long been in the group of the most successful faculties as far as publication of scientific papers in international journals from the SCI list is concerned. To illustrate this, we will use the data found using Google Scholar, which proved to be a very precise search tool which offered us reliable data on the total number of scientific publications registered on the Internet which are recognized at the moment. The total number of publications of the Faculty of Chemistry registered and recognized on the Internet up to now (December 2012) is 1640. Out of that number, 1421 have been published in the period from the year 2000 to the present day. The distribution of publications by years with the growing trend is shown in Picture 3.1.



Picture 3.1. The distribution of international publications from the SCI list from the FC in the period from the year 2000 to December 31st 2012

Considering the fact that the average number of people working at the Faculty of Chemistry who have scientific and research potential – the members of the Scientific and Educational Board, associates and teachers, is somewhat over 80, it means that, since the year 2010, the average production of scientific publications at our Faculty has reached the number of two publications per teacher or associate a year. With this in mind, our strategic goal is to keep the current level of production of scientific papers at the same level and to keep the obvious upward trend.

3.2 INTERNATIONAL PROJECTS

Apart from scientific publications, the evident results are international projects which the Faculty either runs or in which it takes part. In the last period, this includes 14 international projects, such as:

- **High-Performance Computing Infrastructure for Research Communities in South-East Europe** (HP-SEE)
  project financed by: the European Union through "FPT Capacities (Research Infrastructure)" program (Brussels, Belgium)
  project started: September 1st 2010, *estimated project duration:* 2 years
- **Multi-Targeted Compounds** (NO HHSN261200800001E)
  project financed by: SAIC-Frederick, Inc. - NCI at Frederick (Frederick, the United States of America)
  project started: 2009, *estimated project duration:* 3 years
- **New Inhibitors of *Botulinum* Neurotoxin** (NATO CBP EAP.SFPP 983638)
  project financed by: NATO (Brussels, Belgium)
  project started: 2010, *estimated project duration:* 3 years
- **Reinforcement of the Faculty of Chemistry University of Belgrade towards Becoming a Center of Excellence for Molecular Biotechnology and Food Research in the Region of the Western Balkans** (FCUB-ERA 256716)
  project financed by: the European Union (Brussels, Belgium)
  project started: July 1st 2010, *estimated project duration:* 3 years
- **Modernization of Postgraduate Studies in Chemistry and Chemistry-Related Programs** (TEMPUS IV)
  project financed by: the European Union (Brussels, Belgium)
  project started: October 1st 2010, *estimated project duration:* 3 years
- **Interlaboratory Studies for the Region of South-East Europe** (HFM-777)
  project started: 2001, *estimated project duration:* 20 years
- **Second-Generation Small-Molecule Inhibitors of *Botulinum* Neurotoxin** (1U01AI082051-01)
  project financed by: the National Institute of Health (Bethesda, Maryland, the United States of America)
  project started: September 25th 2009, *estimated project duration:* 5 years

- **Improving Health Properties of Food by Sharing Our Knowledge of the Digestive**

Process (INFOGEST) (COST Action FA 1005)
project financed by: the European Union (Brussels, Belgium)
project started: April 5th 2011, *estimated project duration:* 4 years

- **Convergent Distributed Environment for Computational Spectroscopy** (CMST COST Action CM1002)
  project financed by: the European Union (Brussels, Belgium)
  project started: April 4th 2011, *estimated project duration:* 3 years
- **Computational Design of Materials Displaying Room Temperature Magnetic Bistability** (PSTC-1)
  project financed by: the Ministry of Education and Science of the Republic of Serbia (Belgrade), the Ministry of Science and Innovation of the Kingdom of Spain (Madrid, Spain)
  project started: January 1st 2012, *estimated project duration:* 2 years
- **Assistance in the Implementation of the Chemicals Management System in Serbia** (SR 08IBEN02)
  project financed by: the European Union (Brussels, Belgium)
  project started: August 15th 2010, *estimated project duration:* 3 years
- **Multivalent Glycosystems for Nanoscience - MultiGlycoNano** (COST Action CM1102)
  project financed by: the European Union (Brussels, Belgium)
  project started: November 7th 2011, *estimated project duration:* 4 years
- **Training in Supramolecular Chemistry for Students and Young Researchers in the Balkan Area**
  project financed by: the Swiss National Scientific Foundation, the SCOPES program
  project started: 2012, *estimated project duration:* 2 years
- **European Chemistry and Chemical Engineering Education Network 2**
  Reference number: 526259-LLP-1-2012-1-FR-ERASMUS-ENW
  project financed by: the European Union
  project started: 2012, *estimated project duration:* 2 years

3.3 DOMESTIC PROJECTS

There are plenty of domestic projects, so we will only list the ones which are in progress, in which the researchers from the Faculty of Chemistry participate and which are financed by the ministries of the Republic of Serbia (the register numbers and the names of projects are given). There are 31 of them altogether and they are:

- 172002: Design, synthesis and investigation of fullerene-based nanomolecular machines (8 researchers from the FC)

- 172008: Synthesis of aminoquinolines and their derivatives as antimalarials and inhibitors of botulinum neurotoxin A (9 researchers from the FC)

- 172017: Structure-relationship correlation of natural and synthetic molecules and their metal complexes (16 researchers from the FC)
- 172020: Experimental and theoretical study of reactivity and biological activity of stereodefined thiazolidines and synthetic analogs (7 researchers from the FC)
- 172024: Molecular properties and modification of some respiratory and nutritional allergens (13 researchers from the FC)
- 172027: Development of new synthetic methods and their application to the synthesis of natural products and biologically active compounds (10 researchers from the FC)
- 172030: The application of advanced oxidation processes and nanostructured oxide materials to the removal of pollutants from the environment, development and optimization of instrumental techniques for effectiveness monitoring (11 researchers from the FC)
- 172035: Rational design and synthesis of biologically active coordination compounds and functional materials relevant in bionanotechnology (37 researchers from the FC)
- 172048: Synthesis, isolation and characterization of enzymes and small molecules and their application in dissolved and immobilized form in food biotechnology, biofuels and environment protection (1 researcher from the FC)
- 172909: Allergens, antibodies, enzymes and small physiologically important molecules: design, structure, function and importance (22 researchers from the FC)
- 172051: Development of new and improvement of the existing electrochemical, spectroscopic and flow injection analysis (FIA) methods for monitoring the quality of the environment (2 researchers from the FC)
- 172055: Interactions of natural products, their derivatives and complex compounds with proteins and nucleic acids (24 researchers from the FC)
- 172095: Non-covalent interactions of ri-systems and their role in molecular recognition (12 researchers from the FC)
- 176006: Geochemical studies of sedimentary rocks - fossil fuels and pollutants of the environment (16 researchers from the FC)

- 179048: Theory and practice of science in society: multidisciplinary, educational and intergenerational perspectives (15 researchers, 8 of whom are from the FC)
- 43004: Simultaneous bioremediation and soilification of degraded areas for the preservation of natural resources of biologically active substances and development and production of biomaterials and dietary products (2 researchers from the FC)
- 172032: The study of structure-activity relationship of newly synthesized biologically active substances (4 researchers from the FC)
- 172053: Bioactive natural products of indigenous, cultured and edible plants: determination of structure and activity (5 researchers from the FC)
- 173017: The study of structure-function relationship in plant cell wall and changing the wall structure using enzymatic engineering (1 researcher from the FC)
- 173039: Immunomodulatory effects of xenobiotics and biotic environmental factors on populations of murine rodents (3 researchers from the FC)
- 179034: From encouraging initiative, cooperation and creativity in education to new roles and identities in society (1 researcher from the FC)
- 172001: The study of physicochemical and biochemical processes in the environment which influence pollution and investigation of the possibilities for minimizing the consequences (3 researchers from the FC)
- 172014: Design, synthesis, characterization and evaluation of practical application of coordination and organometallic compounds (4 researchers from the FC)
- 172060: New approach to designing materials for energy conversion and storage (1 researcher from the FC)
- 41019: The control of infections with apicomplexan pathogens: from new sites of drug action to prediction (1 researcher from the FC)
- 41026: Pharmacodynamic and pharmacogenomic studies of recently-developed drugs used for treatment of solid tumors (1 researcher from the FC)

- 43007: Study of climate change and its effect on the environment – monitoring the influences, adaptation and mitigation (1 researcher from the FC)
- 43010: Modifications of antioxidant metabolism of plants in order to increase abiotic stress tolerance and identification of new biomarkers with application in remediation and monitoring of degraded habitats (1 researcher from the FC)
- 46010: Development of new encapsulation and enzyme technologies for the production of biocatalysts and biologically active components of food with the aim of improving its competitiveness, quality and safety (3 researchers from the FC)
- 33022: Integrated systems for the removal of harmful components of smoke and development of technologies for realizing thermal power plants and power plants without air pollution (1 researcher from the FC)
- 451-03-2372: In vivo studies of the potential cytostatic and its analogs and improvement of the synthetic pathway (5 researchers from the FC)

The list of innovative projects in which the teachers and associates of the FC participate:

- 451-03-2372-IP Type 1/107: The development of analytical procedures for determining authenticity of Serbian honey
- 451-03-2372-IP Type 1/56: In vivo studies of the potential cytostatic and its analogs and improvement of the synthetic pathways
- 451-03-2372-IP Type 1/79 Antioxidants based on complex selenium compounds – study and development
- 451-03-2372-IP Type 1/51: Enzymatic synthesis of lipid-soluble antioxidants

Out of 89 people employed at the Faculty of Chemistry who work as teachers or scientists, only three of them (3.37%) do not participate in any of the projects of the Ministry of Education, Science and Technological Development, while the rest of them participate in one, and a small number of them in two scientific projects.

The Faculty of Chemistry has always closely collaborated with the Center for Chemistry of the Institute for Chemistry, Technology and Metallurgy (ICTM) and the Innovation Center of the Faculty of Chemistry (ICFC) in the field of science and research. The collaboration has been established ever since the above-mentioned organizations were founded while the papers published and the other results achieved are so much entwined that it is hard to distinguish

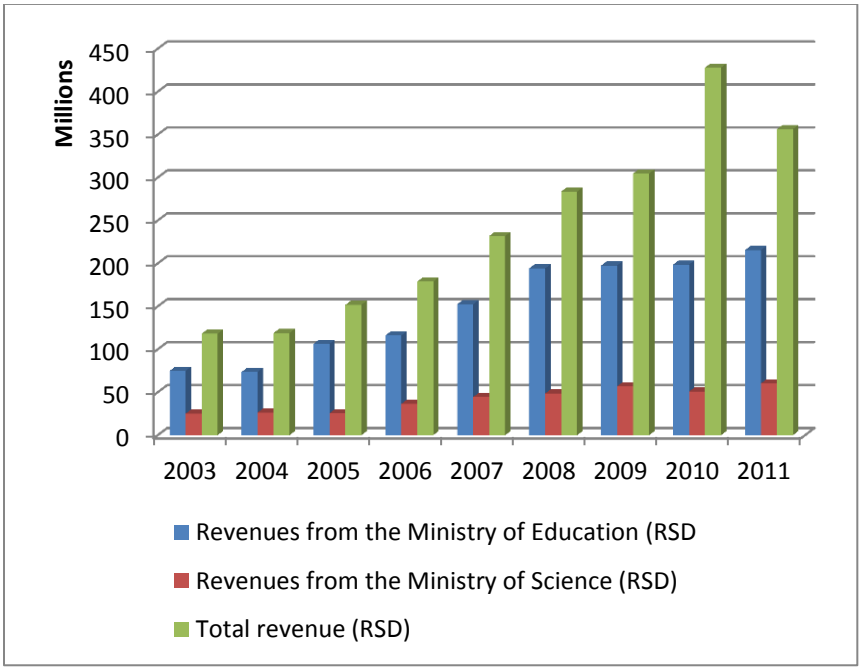
their individual roles and contribution. It remains in the best interest of the Faculty to keep collaborating with these two institutions and to improve the collaboration through joint participation in both domestic and international projects.

The strategic goal of the Faculty is to keep the current trend of scientific activities, while the Faculty has to prepare for participation in international projects, particularly for the projects of the European Union (the EU).

The Faculty of Chemistry has to examine all these possibilities and develop its position and action plan in the near future.

4 FINANCIAL ANALYSIS

The analysis of financial resources available for the needs of the Faculty of Chemistry, the University of Belgrade, shows that in the last nine years (from 2003 to 2011 inclusive), the Faculty had dinar funds which had permanently increased up to 2010, but since 2011 these resources decreased. As it can be seen from Picture 4.1. the FC quadrupled its total income from 2003 to 2010 thanks to the inflow of resources which did not come directly from ministries from which the FC traditionally receives its resources. However, it is indicative that the FC saw a real growth of revenues coming from ministries only in the period from 2004 to 2007 since in that period the state economy had a modest increase of only 2.5 times, but the revenues coming from ministries have been stagnating since 2008.



Picture 4.1. A graphical representation of the financial resources which the Faculty received from the Ministry of Education, the Ministry of Science and the total revenue of the Faculty for the period 2003-2011 given in RSD

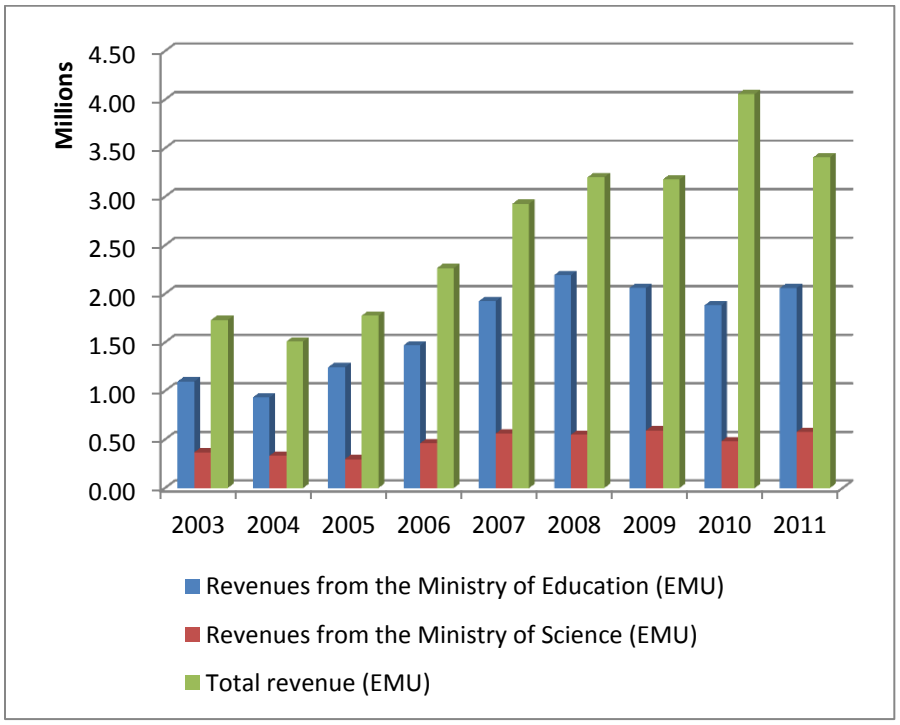
Furthermore, Picture 4.1 and Table 4.1 show that the FC actually receives fewer resources from science considered through the quotient of received revenues science/education, even though the significant scientific contribution of the FC has been evident in the last few years. The relative decrease in the revenues from science, for example from 2004 to (35.7%) to 2010 (25.5%), is slightly higher than 10%. This fact indicates that the Ministry of Science is actually behind the Ministry of Education as far as the amount of money invested in the FC is concerned.

Table 4.1 also gives information on the average value of the EURO compared to the RSD on December 31st for every year in the period from 2003 to 2011. Using these data, we can establish the real value of the revenues the FC has received for the same period shown in Table 4.1. only expressed in euros (Picture 4.2).

Table 4.1. The science/education revenue ratio of the FC and the euro exchange rate for each year in the period from 2003 to 2011

YEAR	2003	2004	2005	2006	2007	2008	2009	2010	2011
Science/education	0.335	0.357	0.239	0.314	0.291	0.249	0.288	0.255	0.280
EURO/RSD middle exchange rate on December 31st of that year	68.31	78.88	85.50	79.00	79.23	88.60	95.88	105.49	104.64

Data from Picture 4.2 are very informative and different compared with Picture 4.1. since they clearly show the fall of the dinar compared with the European currency. This picture also indicates that, since the year 2008, the revenues of the FC have suffered an actual decline even though the revenues expressed in dinars conceal this fact (Picture 4.1).



Picture 4.2. A graphical representation of financial resources which the Faculty received from the Ministry of Education, the Ministry of Science and the total revenue of the FC for the period from 2003 to 2011 expressed in euros

The general trend in Gross National Income (GNI) and the public debt (http://www.nbs.rs/internet/cirilica/index.html) do not indicate that the FC will improve its financial activities in the near future. The FC is an educational and scientific institution and not a profit-making organization but even though making profit is not its primary goal, the results of its work largely depend on received revenues.

It is a strategic imperative that the FC should find other financial resources in order to improve its financial position, maintain its productivity and the leading position in the area of science and keep the advanced role in educational activity.

The essential demands concerning the revenues of the Faculty in the near future would be based on the following elements:

1. expanding participation in international projects,
2. increasing the scope of cooperation with industry,
3. creating educational programs for the employees,
4. creating programs in order to offer training for new technologies and instrumental methods,
5. offering services within this profession (analyses, consultations, revisions…), and
6. issuing certificates.

There is no doubt that each of the identified financial resources requires special attention and action plans.

Expenditure is equally important. Apart from the existing expenditure, we should plan and provide resources for:

1. capital equipment insurance, and
2. the costs of accreditation.

5 EDUCATIONAL ACTIVITY

The Faculty of Chemistry, one of the faculties of the state university, was accredited as an institution of higher education in the year 2008 and since then its educational activity has been officially conducted in accordance with the Bologna Declaration. Following the general goals of the education development in Serbia, as well as the standards established in Europe, the FC intends to completely harmonize its educational process with BENCHMARK EDUCATIONAL STANDARDS FOR CHEMISTRY AND CHEMISTRY-RELATED DISCIPLINES which result from the requirements set by the **European Quality Assurance Agency for Higher Education** and which are therefore accredited throughout Europe and harmonize it with the **European Chemistry Quality Eurolabels for Eurobachelor, Euromaster and Eurodoctorate**. These standards were accepted by the European Association for Chemical and Molecular Sciences in 2003.

5.1 BENCHMARK EDUCATIONAL STANDARDS FOR CHEMISTRY AND CHEMISTRY-RELATED DISCIPLINES

1. The first degree – Undergraduate academic studies

1.1. The statements/requirements below broadly outline the **basic/elementary** level of abilities and skills of the ones who have completed basic academic studies in chemistry and related disciplines:

- Evident basic knowledge and understanding of course contents,
- Problems of routine importance are adequately solved,
- The ability to work safely in the laboratory environment,
- The ability to conduct standard laboratory experiments with satisfying success and he/she should understand and/or realize the significance or limitations of experimental results/data,
- General (generic) skills (for example: expressing oneself orally, in writing or numerically, using information technologies, etc.) developed to a basic level.

1.2. The statements/requirements below broadly outline the **typical /optimal** level of abilities and skills of the ones who have completed undergraduate academic studies in chemistry and related disciplines:

- Has knowledge base which covers relevant aspects of the subject matter dealt with in the program, and shows interest in research as well,
- Good understanding of the concepts/ideas in chemistry,
- Solves familiar problems in a logical way with correct and acceptable solutions,

- Conducts experiments in a reliable and efficient manner,
- Performance in general (generic) skills is sound and without any significant deficiencies,
- Has fundamental knowledge in several other, more specialized, areas of chemistry (for example: forensics, environmental chemistry, green chemistry, industrial chemistry and chemical technology, geochemistry and medicinal chemistry),
- Has developed practical skills in the field of chemistry acquired through laboratory practice in inorganic, analytical, organic and physical chemistry, where they have worked individually or in groups, as necessary in the mentioned areas,
- Has developed general skills in the field of chemistry which can be used in other fields as well,
- Has acquired standard knowledge and competences which enable the student to enroll on the second degree studies. He is well trained in the key areas of chemistry: inorganic, organic, physical, analytical chemistry and biochemistry, and he also has basic knowledge of mathematics and physics.

Typical/optimal level of abilities and skills should be applicable to most students who complete the first degree studies – undergraduate academic studies in chemistry and related disciplines.

2. The second degree – Master academic studies

2.1. The statements /requirements below describe in general **basic/elementary** level of abilities and skills of the ones who hold a master's degree in chemistry and related disciplines:

- Knowledge which includes a systematic understanding and critical awareness of the topics which are latest in that discipline,
- Can solve problems which are not familiar using appropriate methodology and taking into account the possible absence of complete data,
- Conducts experiments entirely independently and with some originality,
- Completes effectively research projects which are at the forefront of the discipline,
- Has general (generic) skills appropriately developed for the purpose of professional practice.

2.2. The statements/requirements below broadly outline the **typical /optimal** level of abilities and skills of the ones who hold a master's degree in chemistry and related disciplines:

- Has knowledge and understanding which is based on, but also exceeds, the knowledge characteristic of the level of master academic studies in chemistry and related disciplines, which enables the student to develop and apply ideas in the research area,
- Has the competencies which meet the requirements made when professional chemists are employed in chemical and chemistry-related production/industry,
- Has competencies which meet the requirements for being employed as a teacher/lecturer in primary or secondary school education,
- Has achieved the level of knowledge and competencies which enable the student to enroll on the third degree studies.

3. The third degree – Doctoral academic studies

The third cycle degree (a PhD) in the field of chemistry is awarded to students who:

3.1. The statements /requirements below broadly outline the typical/optimal level of abilities and skills of the ones who have completed doctoral studies in chemistry and related disciplines:

- Demonstrate systematic understanding of certain narrow areas of chemical sciences and mastery of the skills and methods of research connected with that narrow area of research,
- Demonstrate the ability to understand, project, apply and develop the narrow area of research in chemical science with full integrity and seriousness,
- Have made scientific contributions through original scientific researches which push the knowledge boundaries in chemical science, which originate from considerable individual work and which meet the criteria set by national and international refereed journals,
- Have the competencies which meet the requirements set when employing a professional chemist in managerial positions in chemical and chemistry-related production/industry or which enable them to progress in academic and research milieus,
- Are capable of critical analysis, evaluation and synthesis of new and complex ideas,
- Can communicate with their peers, with the larger academic community or with the society in general on topics from their own discipline,
- Can be expected to promote, within an academic or professional context, scientific or technical achievements in educational environments.

NB

For the purposes of new accreditation/reaccreditation at the FC it is very important that the terminology of *Goals and Outcomes* for each course should be harmonized with the terminology of BENCHMARK EDUCATIONAL STANDARDS FOR CHEMISTRY AND CHEMISTRY-RELATED DISCIPLINES. This should be done both horizontally (for each course of the same study program for the given degree of academic education – all courses of the same degree must have harmonized statements/requirements characteristic of the degree) and vertically (courses of the same study program must be harmonized with the degrees of academic education – each degree has its own characteristic statements/requirements which differ among themselves).

5.2 STUDY PROGRAMS

All types of academic studies are carried out at the Faculty of Chemistry: undergraduate, specialized, master and doctoral studies. The following studies have been carried out since the first accreditation:

a. Undergraduate academic studies (the first cycle of education) through:

- Study program Chemist
- Study program Biochemist
- Study program Chemistry Teacher
- Study program Environmental Chemist.

b. Master academic studies (the second cycle of education) as:
   - Study program Graduate Chemist – Master
   - Study program Graduate Biochemist – Master.

c. Doctoral academic studies (the third cycle of education) as:
   - PhD in Chemical Sciences
   - PhD in Biochemical Sciences.

Harmonizing study programs with the actual needs of the Republic of Serbia while also bearing in mind that the education cycles at the FC need to be completed, it has been established that it is essential that programs within the second cycle of education– at master academic studies should be improved starting from the next accreditation cycle (from the next school year). In this way, it will be possible for students to continue their education on master academic studies within the study programs which are carried out within undergraduate studies. This means that one single study program should be developed on master studies and this study program would contain blocks of elective courses which meet the needs of chemists (analytical chemists, inorganic chemists, organic chemists), biochemists, chemistry teachers and environmental chemists. The result would be a master's diploma in chemistry with a diploma supplement which defines more closely the narrow field within which the student passed exams, wrote his master's thesis and had his viva voce examination:

- Master in Chemistry – Chemistry Teacher
- Master in Chemistry – Environmental Chemist
- Master in Chemistry – …

An alternative solution is to introduce study programs which would complete the range of titles on the second level of education:

- Study program Chemist – Master
- Study program Biochemist – Master
- Study program Chemistry Teacher – Master
- Study Program Environmental Chemist – Master.

This is justified by the fact that within the first accreditation cycle the FC did not offer complete education for two study programs: Chemistry Teacher and Environmental Chemist. For the first program, Chemistry Teacher – Master, there is a legal obligation for education at that level, while for the second one, Environmental Chemist – Master,

students go to other faculties in the country and abroad in order to complete their education and obtain the degree which they are expected to have in order to find a job.
There is another option for the students on the study program Chemistry Teacher and that is introducing integrated studies, which includes integration of the first and second degree of studies, and if the FC has the capacity to do something like that, this solution should be given further consideration.

The final decision will be made by the members of the Scientific and Educational Board of the Faculty of Chemistry.

5.3 THE NUMBER OF STUDENTS WHO HAVE MET THE COURSE REQUIREMENTS

It turned out that, in order to increase the number of students who have met the course requirements on undergraduate studies, it is necessary to introduce separate ECTS for the final exam and the practicum which accompanies the course (laboratory lessons and/or lessons in chemistry calculations and/or theoretical lessons) for the core courses which all students attend.

The course teachers/departments are left with the possibility to implement this where it is possible/necessary since chemistry studies are extremely expensive and very demanding as far as organization is concerned so if a student has successfully completed the practicum but has not passed the exam, he does not have to repeat and pay practical lessons the following year since he has obtained the required number of ESPB credits. Such solutions can already be found at the University of Belgrade.

5.4 TERMS OF ATTENDING LECTURES

For the purpose of new accreditation it is important to reexamine: (1) terms of attending lectures – better defined terms provide the knowledge foundation needed for successful continuation of studies and prevent the obligations from different years from overlapping and (2) the distribution of credits which students gain prior to the exam and in the exam.

5.5 THE LANGUAGE OF STUDIES

The Faculty of Chemistry can opt for accreditation of the second/third level of education in two languages - Serbian and English. However, in that case, all study programs have to be prepared in both languages and they must be available at the Faculty's site. The option of offering studies

in a foreign language, particularly in English, is strongly supported and faculties are encouraged by university bodies to develop such programs.

5.6 MODERNIZATION OF THE TEACHING PROCESS

Modernization of the teaching process at the Faculty of Chemistry is necessary and it refers to introducing modern teaching tools and methods in all its forms. The focus of modernization is on introducing modern teaching tools and methods, and that includes:

- Creating a virtual educational space (for example: introducing appropriate software packages for transferring important information and lectures in electronic format, introducing knowledge checks with the use of IT …) without any intention of turning the studies at the FC into distance education since chemistry is an experimental science and it cannot be "completely virtualized".
- Introducing group projects into master studies with the goal of teaching students how to solve complex problems from the field of industry, research, etc. both in English and in Serbian.
- Restructuring the existing form of final papers into the form of individual projects with the aim of enabling students to solve simple problems from the field of industry or research.
- Restructuring the existing courses, introducing new courses, replacing some courses, modernizing laboratory lessons (with the emphasis on instrumentalization in chemistry).

Each department further defines its own strategic goals of development.

5.7 EVALUATION AS AN INDICATOR OF ACHIEVEMENT

In future, the Faculty of Chemistry will conduct the evaluation of its work using pointers, i.e. indicators of achievement which have been used in Europe and Serbia for a long time. The evaluation will include a series of statistical parameters which are used to measure the level of achieved results (performance) of our educational institution and study programs within the framework of the quality system which has been adopted at the University of Belgrade. Indicators (pointers) of achievement as qualitative and quantitative measurements of the achieved results (output) (short-term measurements of results), and measurements of outcome (long-term measurement of outcome and performance) will be applied to the entire educational program carried out at the FC: undergraduate, master and doctoral studies. Using these parameters, the Faculty will define benchmark measure of the achieved output (performance) for the last period (from the first accreditation to the present day), which will enable a comparison with other educational institutions of our University and other universities in Serbia. The Faculty of

Chemistry has chosen the most widely used indicators of achievement which include: (1) the number of students who have applied compared to the enrolment quotas, (2) points won in the entrance exam, (3) workload of educational and scientific staff, (4) employment of students who have graduated, (5) projects and resources available for researches, (6) the number of published scientific papers and studies, (7) the ratio of students to educational and scientific staff, (8) revenues and expenditure of the educational institution, (9) the space available per student, and (10) equipment and facilities of the institution. These indicators of achievement are most often used in Europe and they have been identified as indicators which are most useful in comparative analysis or in the analysis of profiles of different educational institutions within the same university or several different universities.

6 PERSONNEL POLICY

The Faculty of Chemistry has always devoted special attention to its personnel policy. This attention was primarily focused on personnel policy for the teaching staff, though it normally took care of its non-teaching staff, particularly of the members of its staff who are included in preparations for teaching since they are particularly important for keeping the quality of practical lessons and maintaining the equipment used for scientific research.

6.1 PERSONNEL POLICY FOR THE TEACHING STAFF

The high criteria for electing teachers at the Faculty of Chemistry are its distinctive characteristic at the University of Belgrade. Due to this fact, teaching and scientific staff of our Faculty has achieved outstanding results for decades:

- in education since they educate successful students with diplomas which are recognized worldwide without any additional terms or exams,
- in science since they constantly work on a series of scientific research projects which they obtain at project proposal invitations issued by ministries of our country, and they also participate in international projects of the European Union and other well-known international organizations, and
- since they publish a considerable number of scientific papers in international journals every year, always with the address of our Faculty.

The main requirements set for young staff, as well as for the ones who want to advance and be promoted to higher positions at our Faculty, are that the candidates should have papers published in international journals from the SCI list, published textbooks or corresponding publications relevant for teaching and good marks received when their educational work is evaluated by their students. It should be pointed out that at the Faculty of Chemistry the ranking of scientific journals as top-rated international journals, outstanding international journals and international journals is observed.

Even though the existing criteria for electing teachers have given good results, as it turns out, some of them need to be better defined, considering the fact that there is a growing interest among young people and scientific workers in working in education. We will briefly outline the existing requirements, and we will also add some important elements which should be the strategic goal of our Faculty in realizing its personnel policy in the future.

6.1.1 TEACHING ASSOCIATES – ASSISTANTS

When electing teaching associates, i.e. assistants, the focus should be shifted to where young people are – research assistants and research associates. It is estimated that the number of associates at the Faculty (candidates for a doctor's degree who participate in scientific projects of the Faculty) who can be engaged as teaching associates is rather limited, so young candidates for a doctor's degree from institutions such as Innovation Center of the Faculty of Chemistry (ICFC) or the Center for Chemistry of the Institute for Chemistry, Technology and Metallurgy (ICTM) have to and should be engaged.

6.1.2 DOCTOR OF CHEMICAL/BIOCHEMICAL SCIENCES

The existing requirements are considered reasonable – the candidate has to have two papers published in international journals, at least one of which should be from the group of top-rated or outstanding international journals, while in the future the candidate will be expected to be the first author of both papers.

6.1.3 ASSISTANT PROFESSOR

The existing requirements prescribe five scientific papers in international journals (at least two of which should be from the group of top-rated or outstanding international journals) for the first election.

Due to the growing pressure coming from candidates who have both the sufficient number of scientific papers and experience in teaching gained by giving practical lessons, it is essential to introduce the requirement that the candidate has to complete his postdoctoral studies at least 12 months prior to election.

Before writing any kind of report on candidates for the Assistant Professor position, each candidate must give a public lecture for the members of the Scientific and Educational Board and students of the Faculty of Chemistry in which he will show his teaching skills and the results achieved in the field of science and research.

6.1.4 ASSOCIATE PROFESSOR

The existing requirements prescribe ten scientific papers published in international journals since the last election (at least five of which should be in the group of top-rated or outstanding international journals) for the first election.

If the terms of electing an associate professor are redefined, the Faculty of Chemistry will give priority to quality rather than quantity since it advocates setting stricter requirements in the future as far as the number of papers in top-rated and outstanding international journals is concerned. As far as publications relevant for teaching are concerned, it is believed that a candidate cannot be elected as an associate professor if he has not had a textbook or a corresponding publication relevant to teaching (an additional textbook, a book used for a practicum or a collection of problems) published.

6.1.5 FULL PROFESSOR

The existing requirements prescribe fifteen scientific papers published in international journals since the last election (at least seven of them in the group of top-rated or outstanding journals).

If the terms of electing a full professor are redefined, the Faculty of Chemistry will give priority to quality rather than quantity since it advocates setting stricter requirements in the future as far as the number of papers in top-rated and outstanding international journals is concerned. The candidate who has not been a mentor to at least one PhD candidate or has not had any experience of managing a scientific project or a subproject cannot be a candidate for the position of a full professor at the Faculty of Chemistry.

Further details on the terms of election for these positions should be defined by the Scientific and Educational Board of the Faculty of Chemistry with the help of a special committee and by adopting the special Regulations on election and promotion of teachers at the Faculty of Chemistry.

With the aim of meeting the criteria for election for teaching positions at the Faculty of Chemistry, the strategic goal of the Faculty will be to recognize and provide the equal working conditions for all teachers and associates as far as working space is concerned, naturally, according to their position at the Faculty.

The number of teachers at the Faculty of Chemistry is controlled by the number of students enrolled on undergraduate, master and academic studies. As a state-financed institution, our Faculty has to justify its work continuously to authorized ministries and the University of Belgrade by giving them data on the number of students who have passed exams, their achievements, teachers' workload and how the students have evaluated the work of the Faculty.

In order to keep the achievement at a constantly high level, the Faculty must develop a system of teaching process evaluation which would include direct teaching, mentorship, committees, exams, etc., which has to be included in the Regulations on election and promotion of teachers at the Faculty of Chemistry. The Faculty has not had clearly defined criteria for the evaluation of the teaching process up to now.

Finally, our personnel policy has always been based on the policy of balance between the needed and the possible, that balance must not be disturbed by employing superfluous teachers and associates without any control. A superfluous number of employees always results in financial problems, demotivation and worse work results and that would be the greatest adversary to the requirements set by this strategy.

6.2 PERSONNEL POLICY FOR NON-TEACHING STAFF

The tendency for the number of non-teaching staff to increase has always been present. The existing model of financing state-financed educational institutions sets limits on the number of people employed in non-teaching divisions of the Faculty. The requirements set by the University of Belgrade and the authorized ministry continually increase the volume of work of these departments. On the other hand, the well-timed introduction of information technology (IT) at the Faculty lightens the increased workload of employees which is due to the large number of demands for information and services since IT has made the preparation of information significantly easier and increased the speed of its delivery. The requirements for non-teaching staff primarily refer to improving their computer skills, the skill of preparing electronic documents and electronic communications.

Along with the new Regulations on election and promotion of teachers at the Faculty of Chemistry, it is planned to introduce the new Regulations on the systematization of workplaces, which, among other things, would include and clearly define education necessary for each position, project or limit the level of education, the type of work and the volume of workload for each employee.

Particular attention has to be devoted to projecting positions for technical staff who are directly involved in working with laboratories and instruments used at the Faculty of Chemistry. We have to define clearly the difference between laboratory technicians, their professional qualifications and level of education, and senior associates[2], who are in charge of sophisticated laboratory equipment, their professional qualifications and level of education.

[2] The new systematization of workplaces should include advanced training of senior associates, which can even include doctoral studies, but it should be pointed out that one cannot advance from this workplace to a teaching position.

Administrative staff and the entire non-teaching staff of the Faculty have to be replaced gradually by people who have a very good knowledge of English, who are capable of doing administrative work on international projects (FP, TEMPUS, NATO projects, for example), and who already know how to use computer programs such as "Windows", "Office" and similar. In special cases, in the case of demanding projects which have resources planned for this purpose, administrative staff can be employed for a fixed period of time for the duration of the project.

The Faculty also has the task of preparing and getting modernized in the field of public procurement. For this purpose, a system which would make the process of purchases relevant to teaching uniform for all departments needs to be developed as well as order forms which would be available to everyone but at the same time centralized at the level of the Faculty.

7 THE PROMOTION OF THE FACULTY

The Faculty of Chemistry has also paid considerable attention to the promotion of the Faculty up to now. Indeed, less in the part which relates to its rank and position in Serbian educational and scientific community, and more to the popularization of chemistry as science among youngsters and schoolchildren all around Serbia.

7.1 THE RANK AND POSITION OF OUR FACULTY IN EDUCATIONAL AND SCIENTIFIC COMMUNITY

The rank and position of our Faculty in educational and scientific community are relatively little recognized and known. Even though the Faculty of Chemistry is in the group of faculties of the University of Belgrade at which natural sciences are studied, not much is known about how much it has helped the University of Belgrade to get on the "Shanghai List". Due to the new trends in the process of education and the emergence of private universities, the position of outstanding educational and scientific research institutions, one of which is the Faculty of Chemistry in Belgrade, has become rather blurred in a "sea" of advertisements and promises, i.e. in the easiness of studying which is promoted these days. The only real indicator of the significance of our Faculty would be a rank list of the faculties of state and private universities in Serbia. In future, our Faculty should constantly insist that such a list should be made.

Until the rank list is created and until it becomes widely accepted, the Faculty must regularly work on self-evaluation of its own work using the indicators, i.e. pointers, of achievement and publish them regularly on its site.

7.2 THE POPULARIZATION OF CHEMISTRY AS SCIENCE AMONG YOUNGSTERS AND SCHOOLCHILDREN

The popularization of chemistry as science among youngsters and schoolchildren all around Serbia turned out to be very successful. Thus, for example, the promotional activities called: "Between Magic and Chemistry" or "From Magic to Chemistry" and participation in manifestations such as "The Night of Museums" and "The Science Festival" have produced excellent results and more and more faculties which educate young people in similar disciplines have followed our example. The popularization of chemistry also takes place through a program

called "Open Laboratory" intended for elementary and secondary school students who are given an opportunity to conduct experiments in laboratories of the Faculty of Chemistry.

Giving popular lectures in high schools also produces good results and it should not be neglected in future. Modern society needs to be constantly reminded of our existence and that we have achieved extraordinary results. Nevertheless, we must not always stay the same in this area as well, innovations and changes for the better are necessary.

8 AN OVERVIEW OF KEY STRATEGIC GOALS OF THE FACULTY

Due to the results achieved in the field of science and education, the Faculty of Chemistry holds a leading position as the most eminent and benchmark academic institution in the field of chemical sciences in Serbia. Since it is present in every aspect of everyday life, chemistry makes key contribution to building a better future and well-being of Serbian citizens, which is the primary, global and strategic goal of the Faculty of Chemistry and the institutions which it has founded (the Center for Chemistry of the ICTM and the Innovation Center of the Faculty of Chemistry). By educating chemists of various profiles at all levels and due to the results of its scientific work, the Faculty has a decisive influence in creating and realizing all chemistry-related contents in Serbia.

The Faculty will keep aspiring to have the most distinguished experts on its staff in all specialized scientific fields which are studied at our Faculty, while younger generations will be required to continually assess and improve their professional competencies.

The Faculty of Chemistry, one of the faculties of the state university, was accredited as an institution of higher education in 2008 and since then its educational activity has been conducted in accordance with the Bologna Declaration. Following the general goals of the education development in Serbia, as well as the standards established in Europe, the FC intends to completely harmonize its educational process with BENCHMARK EDUCATIONAL STANDARDS FOR CHEMISTRY AND CHEMISTRY-RELATED DISCIPLINES which come from the requirements of **the European Quality Assurance Agency for Higher Education** and synchronize it with the **European Quality Labels in Chemistry**.

The Faculty of Chemistry, the University of Belgrade, has long been in the group of the most successful faculties as far as publication of scientific papers in international journals from the SCI list is concerned. The total number of publications of the FC up to now (September 2012) which have been registered and can be recognized on the Internet is over 1420 publications. Considering the fact that the average number of people working at the Faculty of Chemistry who have potential for science and research (the members of the Scientific and Educational Board) is slightly over 80, the analysis has shown that since 2010 the average production of scientific publications at our Faculty has reached two publications per teacher or associate a year. With this in mind, our strategic goal is to keep the current level of production of scientific papers at the same level and to maintain the obvious upward trend.

The strategic goal of the Faculty is to keep the current trend in scientific and project activities – at the moment the members of the Faculty are engaged on 31 domestic and 14 international

projects, but the Faculty has to prepare for participation in international projects, particularly in the projects of the European Union (the EU).

The Faculty of Chemistry has always closely collaborated with the Center for Chemistry of the Institute for Chemistry, Technology and Metallurgy (ICTM) and the Innovation Center of the Faculty of Chemistry (ICFC) in the field of science and research. It remains in the best interest of the Faculty to keep the collaboration with these two institutions and to improve the collaboration through joint participation in both domestic and international projects.

The high criteria for electing teachers at the Faculty of Chemistry are its distinctive characteristic at the University of Belgrade. Even though the existing criteria have given good results up to now, it turned out that some of them need to be better defined, considering the fact that there is a growing interest among young people and scientific workers in working in education.

Finally, the only true indicator of the significance of our Faculty is the rank order of the faculties of state and private universities in Serbia – in future, the Faculty should constantly insist that such a list should be made.

All requirements planned by this Strategy will be realized through separate action plans, through work of special committees and through everyday activities of the management of the Faculty.

In Belgrade, January 2013

THE SCIENTIFIC AND EDUCATIONAL BOARD
OF THE FACULTY OF CHEMISTRY