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Project 561525-EPP-1-2015-1-LV-EPPKA2-CBHE-JP
Improvement of master-level education in the field
of physical sciences in Belarusian universities
15/10/2015 – 14/10/2018

WP2: Development and Implementation of Curricular

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Goal of presentation:

- **Objectives of the project: indicators and measuring of the progress**



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Goal of presentation:

- **Objectives of the project: indicators and measuring of the progress**
- **Identifying the principles of higher education in Belarus: before and after**



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Goal of presentation:

- **Objectives of the project:** indicators and measuring of the progress
- **Identifying the principles of higher education in Belarus: before and after**
- **Description of WP2: main tasks, results and important activities**



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Goal of presentation:

- **Objectives of the project: indicators and measuring of the progress**
- **Identifying the principles of higher education in Belarus: before and after**
- **Description of WP2: main tasks, results and important activities**
- **Resume**



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**Objectives of the project:
indicators and measuring of the progress**



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Wider objective of the project:

- **To upgrade curricula in physical sciences in four universities of Belarus according to Bologna practices,**
- **to enhance the quality and relevance of education in the field of physics by modernisation of study programs, the enhanced use of ICT and networking activities to the labour market needs.**



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Indicators of progress:

- **Developed, tested and formally approved *curricula and study materials* in accordance to labour market needs basing on Bologna practices;**



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Indicators of progress:

- Developed, tested and formally approved ***curricula and study programs*** in accordance to labour market needs basing on Bologna practices;
- Developed ***didactic materials*** (e-Books, guides for laboratory works, lecture synopsises, etc.) for upgrading master-level education in the field of physical sciences (functional nanomaterials, photonics, applied physics, etc.);



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Indicators of progress:

- Developed, tested and formally approved ***curricula and study materials*** in accordance to labour market needs basing on Bologna practices;
- Developed ***didactic materials*** (e-Books, guides for laboratory works, lecture synopsises, etc.) for upgrading master-level education in the field of physical sciences (functional nanomaterials, photonics, applied physics, etc.);
- Readiness for transition from existing “5 + 1” system of education ***to a new training system “4 + 2”*** (4 years for bachelors and 2 years for master students study)



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How indicators will be measured:

- ***University's registries*** (educational plans and programs).
- ***Interim and final evaluation reports***, including feedback from students, teachers, student's governance and also industry and Non-Governmental Organisations representatives



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Special objectives of the project:

- ***To develop modern master programs*** in the field of functional nanomaterials, photonics and applied physics for four Belarusian universities, which respects principles of the Bologna process;



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- ***To develop modern master programs*** in the field of functional nanomaterials, photonics and applied physics for four Belarusian universities, which respects principles of the Bologna process;
- ***To develop and update courses and teaching materials*** for two master-level model (standard) educational programs for specialities “Functional nanomaterials” and “Photonics”;



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- ***To improve teachers’ qualifications and skill;***



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- ***To improve teachers’ qualifications and skill;***
- ***To improve teachers/students skill in practical English;***



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- ***To develop and update courses and teaching materials*** for two master-level model (standard) educational programs for specialities “Functional nanomaterials” and “Photonics”;
- ***To improve teachers’ qualifications and skill;***
- ***To improve teachers/students skill*** in practical English;
- **To enhance Belarusian academic staff competences for teaching of the developed courses in English;**



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Special objectives of the project:

- To implement *modern technical infrastructure* for teaching and learning;



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Special objectives of the project:

- To implement *modern technical infrastructure* for teaching and learning;
- To develop *innovative ICT-based teaching and learning environment*;



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Special objectives of the project:

- To implement ***modern technical infrastructure*** for teaching and learning;
- To develop ***innovative ICT based teaching and learning environment***;
- To bring the Higher Education Institutions (HEIs) of Belarus closer ***to the Labour Market needs***.



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Special objectives of the project:

- To implement *modern technical infrastructure* for teaching and learning;
- To develop *innovative ICT based teaching and learning environment*;
- To bring the Higher Education Institutions of Belarusian closer *to the Labour Market needs*.
- To bring the HEI of Belarus closer *to Bologna system principles*.



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Special objectives of the project:

- To implement *modern technical infrastructure* for teaching and learning;
- To develop *innovative ICT based teaching and learning environment*;
- To bring the Higher Education Institutions of Belarusian closer *to the Labour Market needs*.
- To bring the Higher Education Institutions (HEIs) of Belarus closer *to Bologna system principles*.
- To enhance the ICT skill that are required for new graduates *to make easier their way into the industrial/scientific institutions*.



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Identifying the principles of Higher Education in Belarus: before and after



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Before 2014, training process for students of BSU, BSTU, GoSU and GrSU was constructed using mainly 3-stage education system “5 + 1 + 3” by all Specialities both in Physical sciences and Engineering.



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FIRST DEGREE of HIGHER EDUCATION (5 year)

Speciality:

1-31 04 01 - Physics (in directions)

Qualifications:

- «Physicist. Researcher»
- «Physicist. Engineer»
- «Physicist. Lecturer of physics and information science»
- «Physicist. Manager»

Holder of Diploma “Diplomaed specialist”



SECOND DEGREE of HIGHER EDUCATION (1 year)

Speciality:

1-31 04 01 - Physics (in directions)

Holder of a master's degree



PhD STUDENTSHIP (3 years)

Branches of Science:

01.04 - Physics and Mathematics (in specialities)

Holder of PhD degree in physics and mathematics

In accordance with “Sertified Specialist Academic Education Programme” up to 2013-2014 education year, the training process by speciality "1-31 04 01 - Physics" was devided *on 3 stages*:

- 1. General Programme for 1-4 courses (General Physics, Higher Mathematics, Theoretical Physics, etc.)**

2.

Fig. 1. The flowchart for speciality 1-31 04 01 - Physics in BSU before 2013-2014 educational year



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- 1. General Programme** for 1-4 courses (General Physics, Higher Mathematics, Theoretical Physics, etc.)
- 2. Diploma Programme** for 3-5 courses (for qualifications/skill "research activity", "engineering activity" and “management activity" including 12-18 specializations).

Fig. 1. The flowchart for speciality 1-31 04 01 - Physics in BSU before 2013-2014 educational year



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In accordance with “Sertified Specialist Academic Education Programme” up to 2013-2014 education year, the training process by speciality "1-31 04 01 - Physics" was devided *on 3 stages*:

- 1. General Programme** for 1-4 courses (General Physics, Higher Mathematics, Theoretical Physics, etc.)
- 2. Diploma Programme** for 3-5 courses (for qualifications/skill "research activity", "engineering activity" and “management activity" including 12-18 specializations).
- 3. Three-year PhD programme** for the branch of science “01.04 - Physics and Mathematics” (by Specialties)

Fig. 1. The flowchart for speciality 1-31 04 01 - Physics in BSU before 2013-2014 educational year



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Striving to reform Belarusian high education system according to the Bologna process, since academic year 2014-2015 Belarusian Ministry of Education set the target *for the most HEIs to reform curricula from the existing system "5 + 1 + 3" to the system "4 + 2 + 3".*

Fig. 2. The flowchart for some specialities in Physics in BSU since 2013-2014 educational year



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**FIRST DEGREE of
HIGHER EDUCATION (4 year)**

Specialities:
Functional nanomaterials
Fotonics
Fundamental physics
Computer simulation physics

Qualifications:
- «Physicist. Engineer»
- «Physicist. Manager»

**Holder of Diploma “Diplomaed
specialist”**



**SECOND DEGREE of
HIGHER EDUCATION (2 year)**

Functional nanomaterials
Fotonics
Fundamental physics
Computer simulation physics

Holder of a master's degree



PhD STUDENTSHIP (3 years)

Branches of Science:
01.04 - Physics and Mathematics
(in specialities)

**Holder of PhD degree in physics
and mathematics**

Striving to reform Belarusian high education system according to the Bologna process, since academic year 2014-2015 Belarusian Ministry of Education set the target for *the most HEIs* to reform curricula *from the existing system* **“5 + 1 + 3” to the system **“4 + 2 + 3”**.**

Fig. 2. The flowchart for some specialities in Physics in BSU since 2013-2014 educational year



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WP2: “Development and modernizing of curricula“

**Description of WP2:
tasks, results and important activities**



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Description of WP2: tasks, results and important activities

Start Date	15.02.2016	End Date	30.10.2018
Leading Organisation	BSU		
Participating Institutions	RTU, KU Leuven, UCY, GrSU, GoSU, BSTU, MERB, BPS, RANI, INP of BSU, LOTIS-TII		



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Main tasks of WP2:

- ***Development and modernizing of some master-level curricula*** in 4 Belarusian universities;



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Main tasks of WP2:

- ***Development and modernizing of some master-level curricula*** in 4 Belarusian universities;
- ***Development and accreditation of new master-level programs :***
 - a) Development and accreditation in the Ministry of Education of RB (MERB) of standard program;***
 - b) Belarusian universities will also provide internal accreditation in their universities;***
 - c) Belarusian universities will make re-accreditation of final master-level programs in the MERB after testing beyond the project.***



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Main results of WP2: Outputs (tangible) and Outcomes (intangible):

**2.1. Developed and translated to teaching language
*master-level study programs and courses for two
specialities: "Functional nanomaterials" and
"Photonics"***



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Main results of WP2: Outputs (tangible) and Outcomes (intangible):

2.1. Developed and translated to teaching language *master-level study programs and courses for two specialities: "Functional nanomaterials" and "Photonics"*

2.2. Master-level *Standard Programs accreditation* in the MERB



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Main results of WP2: Outputs (tangible) and Outcomes (intangible):

2.1. Developed and translated to teaching language *master-level study programs and courses for two specialities: "Functional nanomaterials" and "Photonics"*

2.2. Master-level *Standard Programs accreditation* in the MERB

2.3. *5 electronic e-Books* by the declared directions (see, below)



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Main results of WP2: Outputs (tangible) and Outcomes (intangible):

2.1. Developed and translated to teaching language *master-level study programs and courses for two specialities: "Functional nanomaterials" and "Photonics"*

2.2. Master-level *Standard Programs accreditation* in the MERB

2.3. *5 electronic e-Books* by the declared directions (see, below)

2.4. *The master-level courses developed on the base of 5 e-Books and tested during two years*



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**Main results of WP2:
Outputs (tangible) and Outcomes (intangible):**

***2.5. Master-level study courses accreditation in
Belarusian universities***



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**Main results of WP2:
Outputs (tangible) and Outcomes (intangible):**

**2.5. *Master-level study courses accreditation* in
Belarusian universities**

**2.6. *Documents for master-level curricula
accreditation* in the MERB**



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**Main results of WP2:
Outputs (tangible) and Outcomes (intangible):**

**2.5. *Master-level study courses accreditation* in
Belarusian universities**

**2.6. *Documents for master-level curricula
accreditation* in the MERB**

**2.7. *Academic staff improved professional and
practical English skill***



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Main results of WP2: Outputs (tangible) and Outcomes (intangible):

2.5. *Master-level study courses accreditation in Belarusian universities*

2.6. *Documents for master-level curricula accreditation in the MERB*

2.7. *Academic staff improved professional and practical English skill*

2.8. *Belarusian universities readiness for transition from existing system "5 + 1" to new "4 + 2" system*



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Main activities of WP2:

2.1. Development of lecture synopsis and compatible teaching (didactic) materials in English and translation to teaching languages for Belarusian universities



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Main activities of WP2:

2.1. *Development of lecture synopsises and compatible teaching (didactic) materials in English and translation to teaching languages for Belarusian universities*

2.2. *Academic/teaching/technician staff training on curricula topics, ICT tools and English languages skill*



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Main activities of WP2:

2.1. *Development of lecture synopsises and compatible teaching (didactic) materials in English and translation to teaching languages for Belarusian universities*

2.2. *Academic/teaching/technician staff training on curricula topics, ICT tools and English languages skill*

2.3. *Workshops for curricula development: WS2 – WS9*



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Main activities of WP2:

2.1. *Development of lecture synopsis and compatible teaching (didactic) materials in English and translation to teaching languages for Belarusian universities*

2.2. *Academic/teaching/technician staff training on curricula topics, ICT tools and English languages skill*

2.3. *Workshops for curricula development: WS2 – WS9*

2.4. *Master-students training*



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Main activities of WP2:

***2.5. Master study Standard Programmes
accreditation in the MERB***



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Main activities of WP2:

2.5. *Master study Standard Programmes accreditation* in the MERB

2.6. *The 1st year testing* of two-year master-level programs



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Main activities of WP2:

2.5. *Master study Standard Programmes accreditation* in the MERB

2.6. *The 1st year testing* of two-year master-level programs

2.7. *Preparation of curricula for accreditation* in Belarusian universities during the project implementation and in the MERB beyond the project



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Main activities of WP2:

2.5. *Master study Standard Programmes accreditation* in the MERB

2.6. *The 1st year testing* of two-year master-level programs

2.7. *Preparation of curricula for accreditation* in Belarusian universities during the project and in the MERB beyond the project

2.8. *Measuring of a feedback*



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Short description of Results and Activities in WP2:

2.1. Development of lecture synopsises, compatible teaching (didactic) materials in English and translation to teaching languages for Belarusian universities

Description	Developed and translated to teaching language master-level study programs and courses for specialties “Functional nanomaterials” and “Photonics”
Due date	30.08.2018
Languages	English and Russian
Target groups	Teaching staff; Master-students; Trainees



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Short description of Results and Activities in WP2:

2.2. Academic/teaching/technician staff training on curricula topics, ICT tools and English languages skill

Description	The set of documents for accreditation in the MERB
Due date	30.10.2017
Languages	Russian
Target groups	Teaching staff; Trainees; Technical staff; Other: MERB, project stakeholders



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Short description of Results and Activities in WP2:

2.3. Five e-Books by the declared directions

Description	Development of e-Books in English by 5 directions: “Applied Physics”, “Functional nanomaterials”, “Photonics”, “Applied Informatics”, “Research towards master thesis”
Due date	28.02.2018
Languages	Russian and English
Target groups	Teaching staff; Master-students; Trainees; Technical staff; Other: MERB, project stakeholders



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Short description of Results and Activities in WP2:

2.4. The master-level courses tested during one year

Description	The master-level courses tested during one year and Testing report
Due date	30.09.2018
Languages	Russian English (Report)
Target groups	Teaching staff; Master-students; Trainees; Technical staff; Other: MERB, project stakeholders



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Short description of Results and Activities in WP2:

2.5. Master study courses accreditation in the Ministry of Education

Description	Curricular materials and set of documents related accreditation in Belarusian universities of Master-level study courses
Due date	30.10.2018
Languages	Russian
Target groups	Teaching staff; Master-students; Trainees; Administrative staff; Technical staff; Other: MERB, project stakeholders



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Short description of Results and Activities in WP2:

2.6. Documents for master-level curricula accreditation in the Ministry of Education

Description	Each Belarusian university prepare final documents for own master-level curricula accreditation in MERB after 2-years testing beyond the project
Due date	30.10.2018
Languages	Russian
Target groups	Teaching staff; Master-students; Trainees; Administrative staff; Technical staff; Other: MERB, project stakeholders



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Short description of Results and Activities in WP2:

2.7. Belarus universities readiness for transition from existing system “5 + 1” to new system “4 + 2”

Description	Transition of Belarusian universities from existing system “5 + 1” to “4 + 2” in the field of applied physics, functional nanomaterials and photonics
Due date	30.10.2018
Languages	Russian
Target groups	Teaching staff; Master-students; Trainees; Administrative staff; Technical staff; Other: MERB, project stakeholders



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On the basis of compatible types of training programs, providing lecture courses, laboratory sessions, etc., ***the following e-Books will be developed*** in English and translated into Russian:

Course title	Lider	Participants
Applied Physics	KU Leuven (Belgium) Prof. R. De-Craemer	RTU, BSU, BSTU, GrSU, GoSU
Applied Informatics	Riga Technical University (Latvia) Prof. N. Kunicina	RTU, UCY, KU Leuven, BSU
Photonics	Belarusian State University (Belarus) Prof. A. Tolstik	BSU, RTU, GRSU, GoSU,
Functional nanomaterials	Belarusian State University (Belarus) Prof. A. Fedotov	GoSU, GrSU, BSTU, KU Leuven
Research towards master thesis/management of scientific projects	University of Cyprus (Cyprus) Prof. E. Kyriakides	KU Leuven, RTU, BSU, GrSU, GoSU



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Preliminary contents of e-Books

1. Applied Physics (curator – KU Leuven)

1.1. Electricity and magnetism

1.2. Reliability in the (practical) set-up of physical systems

1.3. Applied Material Science

1.4. Modern measurement technics

1.5. Electrical engineering



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Preliminary contents of e-Books

2. Functional nanomaterials (curator – BSU)

2.1. Nanostructured materials: synthesis, properties and diagnostics

2.2. Physics-chemistry of dispersed systems

2.3. Application of nanomaterials

2.4. Nanoelectronics



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Preliminary contents of e-Books

3. Photonics (curator – BSU)

3.1. Optoelectronics and Nanophotonics

3.2. Laser physics and nonlinear optics

3.3. Coherent Optics and Holography



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Preliminary contents of e-Books

4. Applied Informatics (*curator - RTU*)

4.1. Signal transmitting in heterogeneous environment

4.2. Fibre optics and optical information processing

4.3. Optical waveguides, optical fibers

4.5. Input-output system

4.6. Waveguide modes

4.7. Fibre optical transmission system

4.8. Fibre sensors

4.9. The Fourier transform of the image and spatial

filtering

4.10. Optical bistability and selfpulsing of intensity

4.11. Optical networks in industrial systems



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Preliminary contents of e-Books

5. Research towards master thesis/scientific project management (*curator - UCY*)

5.1. Master thesis general requirements

5.2. Selection of innovative topics

5.3. Information search

5.4. International intellectual property rights

5.5. Standards and standardisation

5.6. Scientific project management

5.7. Bringing offers to market

5.8. Presentation

5.9. Commercialization / product management

5.10.e-marketing

5.11. Quantify and qualify students' competences to be acquired during master thesis work

5.12. Evaluation methodology for students' master thesis

5.13. Formal requirements in Belarus – special methodical annex



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Resume

Thus, as a result of the project implementation, we should create an integrated, logically-connected system of complementary educational approaches and tools, allowing

- to carry out training of the teaching/technical staff of Belarusian universities, and**

- to improve the training of master-students**

in the physical sciences by practice-oriented master-level programme.



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Thank you for attention

Prof. A.K. Fedotov (BSU)

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