Tempus

Analysis of guidelines and standards for Bioengineering and Medical Informatics degree programmes

Executive Summary

BioEMIS is a European Commission Tempus project to develop new study programmes in Bioengineering and Medical Informatics at universities in the West Balkans. This report summarises the work undertaken in work package 1.3 to analysis the guidelines and standards for Bioengineering and Medical Informatics degree programmes.

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Table of Contents

1. Introduction

BioEMIS is a European Commission Tempus project to develop new study programmes in Bioengineering and Medical Informatics (BE&MI) at universities in the West Balkans (WB). This report summarises the work undertaken in work package 1.3 to analysis the guidelines and standards in Bioengineering and Medical Informatics degree programmes.

2. Structure of the study program

2.1 First and second level of higher education

Each study program shall have the following elements:

- name and objectives of study programs;
- type of studies and outcomes of the learning process;
- professional, academic, namely scientific title;
- conditions of admission to the study program;
- list of obligatory and optional study areas, namely courses with framework contents;
- the method of the study and the time needed for individual types of studies;
- credits of each course expressed in terms of the European credit transfer system (ECTS);
- preconditions for admission to individual courses or groups of courses;
- manner of choice of courses and other study programs;
- conditions for transfer to other study programs within the same or related study areas;
- other issues of significance for the realization of study programs.

2.2 Doctoral studies

The doctoral studies carry minimum 180 ECTS credits, with the prior achievement of the volume of studies of at least 300 ECTS credits at the basic academic and diploma academic studies, namely 360 ECTS credits at the integrated basic and diploma academic studies of medical sciences. The doctoral dissertation is the final part of the study program at the doctoral studies. Each study program shall contains clear and unequivocally stated elements as follows:

- name and objectives of the study program;
- learning process outcome;
- scientific title;
- admission criteria;
- list of obligatory and optional study areas, namely courses with the frame contents,
- the manner of delivery of the studies - credit values of each course expressed in terms of the European credit transfer system;
- value of doctoral dissertation expressed in ECTS credits;

- preconditions for admission to individual subjects or groups of subjects;
- the manner of selection of subjects from other study programs at the same or another university;
- conditions for transfer from other study programs within the same or related study areas;
- and other matters of relevance for the delivery of study program.

3. Purpose of study programs

3.1 First and second level of higher education

The study program shall have clearly defined purpose and the roles in the education system, accessible to the public. The purpose of the study program is to educate the students for recognizable and clear professions and occupations. The study program shall ensure acquisition of competences, which are socially justified and useful. The purpose of realization of the study program must be clearly and unequivocally formulated.

3.2 Doctoral studies

Study program of doctoral studies has a clearly defined and published purpose and the role in the education system. The purpose of the study program shall be clearly and unequivocally formulated. The purpose of the study program of doctoral studies is the development of science, critical opinion and education of professionals capable of independent guidance of or original and scientifically relevant research and development of new technologies and procedures conducive to the general development of society, and scrutiny for the research of others The purpose of the study program must be in compliance with the mission and objectives of the higher education institution where the program is delivered.

4. Objectives of study program

4.1 First and second level of higher education

The study program shall have clearly defined objectives. The objectives of study program include the achievement of competences and academic skills and methods of their acquisition, The objectives may also include the development of creative capacities and mastering of specific practical skills necessary in practicing the trade. The objectives of study program shall be in compliance with the basic goals and objectives of higher education institution where the program is carried out. The objectives of the study program implementation must be clearly and unequivocally formulated.

4.2 Doctoral studies

The study program of the doctoral studies shall have defined objectives. The objectives of study program include building of scientific capacities and academic skills, development of creative abilities and mastering of specific practical skills needed for future career advancement. The objectives of the study program of doctoral studies are harmonized with the modern trends of the corresponding scientific discipline in the world. The objectives of the study program must be in keeping with the basic goals and objectives of the higher education institution where the program is rendered.

5. Competences of graduated students

5.1 First and second level of higher education

By completing the study program a student acquires general and course-specific capabilities serving the function of good quality professional, scientific and artistic activity. Having completed the master program the student shall acquire the following general abilities:

- to analyze and synthesize the solutions and consequences;
- to master the methods, procedures and research processes;
- to develop critical and self-critical capabilities and agility and the cooperation with closer social and international stakeholders;
- observe the professional code of conduct.

Having completed the master program the student shall acquire the following course specific abilities:

- fundamental understanding and comprehension of the discipline of the corresponding profession;
- resolution of concrete problems in different areas and their application;
- linking the basic knowledge in different areas and their application;
- follow-up and application of novelties in the profession;
- development of skills and abilities to use the knowledge in the given field;
- use ICT in getting the knowledge in the given area.

5.2 Doctoral studies

The student who completed the study program of the doctoral studies acquires general and specific capacities second to the quality of performance of the professional, scientific and artistic activity. The program of doctoral studies should enable the students, after the completion of the study, to have knowledge, skills, developed abilities and competences for:

- independent solution of practical and theoretical problems in the area they covered and organize and carry out R&D;
- integration into the international scientific projects;

- carrying out the development of new technologies and procedures within their professions and to understand and use the latest knowledge in the given scientific area;
- thinking critically and acting creatively and independently;
- observing the principles of the code of ethics of goods scientific practice;
- communicate at the professional level in presenting their science research results, are trained to present the results at the scientific conferences, publish them in the scientific magazines, via patens and new technical solutions;
- contributing to the development of a scientific discipline and science in general.

Having completed the study program the student acquires the subject-specific competences, as follows:

- fundamental knowledge and understanding of the discipline of the corresponding occupation;
- capacity of solving the problems by using scientific methods and procedures;
- compilation of the basic knowledge from different areas and their application;
- capacity to follow up contemporary achievements in the profession;
- develop skills and agility to use knowledge in the respective field;
- use the ICT in mastering the knowledge in the relevant area.

6. Curriculum

6.1 First and second level of higher education

The curriculum of study program contains the list and structure of obligatory and optional courses and modules and their description. The structure of the curriculum shall cover the distribution of courses and modules by semesters, trimesters, namely blocks, the stock of lessons of active teaching within ECTS. The description of courses shall contain the name, type of the course, the year and semester of studies, the number of ECTS credits, name of the teacher, objective of the course with expected outcomes, knowledge and competences, preconditions for attendance at the course, content of the course, recommended literature, methods of implementation, the way of assessment of knowledge and grading system and other data.

The structure of the study program at the basic academic studies, except in the field of art, shall contains the following groups of courses with a relative share in the total number of ECTS credits, as follows:

- academic-general education-around 15%
- theoretical and methodological - around 20%

- scientific namely artistic professions around 35% and
- professional applied-around 30%.

The structure of study program at the basic professional studies, except for the field of arts, shall contain he following groups of courses relative to the total number of ESTC , as follows:

- academic- general educational-around 15%
- professional, namely art professional - around 40% and
- professional applicative-around 45%.

In the structure of the study programs, except in the field of art, the optional courses are represented with at least 20% relative to the total number of ECTS credits at the basic studies and minimum 30% relative to the total number of ECTS credits at the diploma studies.

6.2 Doctoral studies

Curriculum contains a list and structure of obligatory and optional subjects and models with description and doctoral dissertation as a final part of the study program of the doctoral studies, except the doctors of art, which is an artistic program. Curriculum of doctoral studies enables insight of the students into the knowledge, skills and capacities they acquire during the studies. Curriculum contains the defined fundamentals for independent research work of the students. Curriculum defines the subjects and modules by volume and contents and the manner of realization.

The description of the contents contains the name, type of the subject, year and semester of studies, number of ECTS credits, name of the professor, the objective of the subject with the expected outcomes (knowledge and capacities), pre conditions for attendance, contents of the subject, recommended literature, methods of delivery of teaching, assessment of knowledge and grading and other appropriate data.

The number of credits corresponding to the optional subjects is minimum 50% of the total number of credits that correspond to all the subjects of the study program.
Curriculum more closely defines the requirements concerning the preparation of doctoral dissertation, specific for every educational scientific namely educational artistic field within the area.

The doctoral dissertation is an independent scientific or artistic work of the students at the doctoral studies.

The procedure for application, elaboration and defense of the doctoral dissertation is specified in the general bylaw of the independent higher education institution.
The number of credits for doctoral dissertation enters the total number of credits needed for finalization of doctoral studies.

At least a half of ECTS credits foreseen for the realization of doctoral studies goes to the doctoral dissertation and subjects which are connected with the topic of the doctoral dissertation.

7. Quality, modernity and international compatibility of the study program

7.1 First and second level of higher education

The study program is harmonized to the contemporary trends in the world and status of the profession, science and art in respective education-scientific, namely education artistic field and is comparable to the similar programs of the higher education institutions abroad, and specifically within the European education area. The study program offers the students the latest scientific, artistic namely professional knowledge in the corresponding fields.

The study program is comprehensive and compliant with other programs of higher education institutions. The study program is harmonized to at least three accredited programs of a foreign higher education institution of which at least two of the higher education institutions located in the European educational area. The study program shall be formally and professionally adjusted to the European norms in terms of admission, duration, requirements for transfer to the next year, acquisition of diplomas and the manner of study.

7.2 Doctoral studies

The study program follows the modern world trends and status in the profession and science in the corresponding educational scientific, nearly education artistic field and compare with the similar programs at the foreign giver education institution within the European educational area. The study program offers the students the state-of-the-art knowledge in the area covered and follows the latest achievements in science. The study program is comprehensive and uniform and convergent with the other programs of the higher education institution.

The study program is formally and structurally convergent with at least three accredited foreign programs, of which at least two within the European education area. There is formal and structural convergence of the national study program with the approved subject specific accreditation standards. The study program is convergent with the European standards in

terms of admission terms, duration of studies, conditions for transfer to the next year, acquisition of the diploma and the manner of studies.

8. Admissions

8.1 First and second level of higher education

The higher education institution, in compliance with the social needs and its own resources, shall enroll the student to corresponding study program based on the success in their previous schooling and entrance tests, aptitude and capacities. The number of students enrolled to corresponding study program shall be fixed in terms of available space and human resources available to the higher education institution. The type of knowledge, aptitudes and capacities tested on entrance shall be suitable to the nature of the study program and the method of testing correspond to the character of the study program and shall be publicly available in the admission advertisement.

8.2 Doctoral studies

The higher-education institution in line with the social demands and requirements of the development of science, education and culture and its resources shall demit the students to the study program of the doctoral studies. The number of students admitted to the study program is established relative to available premise, teachers and other possibilities of the institution and estimated social demands at the labor market.

The candidates who achieved the volume of studies of at least 300 ECTS credits in the basic academic and diploma academic studies have the right to apply for admission, namely 360 ECTS credits on the integrated basic and diploma academic studies in medical sciences, as well as on the basis of credits earned during those studies and tests , abilities and capacities. The doctoral studies require fluency in at least on foreign language determined by the higher-education institution. The type of knowledge, abilities, and capabilities tested on admission as well as the manner of testing are published in the competition advertisement.

9. Grading and promotion of students

9.1 First and second level of higher education

The grading of the students shall be based on the permanent monitoring of the work of students and on the credits gained in fulfillment of pre-examination duties and the exam itself. The student completes the study program by taking exams and gaining certain number of ECTS credits in line with the study program. Each individual course in the program shall have a certain number of ECTS credits, which the students can get if they pass the exam. The number of ECTS credits shall be determined on the basis of the work

load of students in mastering certain course and by application of uniform methodology of a higher education institution for all under the given study program.

The success of the student in mastering certain course shall be permanently monitored during the teaching and expressed in credits. The maximum number of credits achievable in the course will be 100. The student earns the credits in the course by attending the teaching and fulfilling the pre examination obligations and by passing the exam. The minimum number of credits achievable by fulfilling the obligations during the teaching will be 30 and the maximum 70.

Each course in the study program shall have clear and transparent way of earning the credits. How the credits can be earned during the teaching shall depend on the number of credits the student earns during the teaching or performing the pre exam obligation and at the exam.

The overall success of the student at a course shall be expressed in grades from 5 (failed) to 10 (excellent). The grade of the student is based on the total credits earned by meeting the pre exam obligations and passing the exam according to the quality of acquired knowledge and skills.

9.2 Doctoral studies

The grading of the students is performed by permanent follow up of the work and on the basis of credits acquired by in performance of pre examination obligations and taking the exam. The doctoral dissertation is awarded on the basis of indicators of its scientific namely artistic contribution.

The students master the study program by taking the exams which carry certain number of ECTS credits. The number of ECTS credits for each subject is determined on the basis of the work load of students during the learning of the subject and by application of accepted in advance and uniform methodology for all the subjects and programs of higher education institution.

The dissertation is final part of the study program of doctoral studies. The dissertation is part of the study program of the doctoral study. The dissertation is an independent science research work. The accomplished scientific contribution is graded according to the number of the scientific publications, patents or technical improvements. The conditions to be met are defined within the areas to come to the defense of the doctoral dissertation, based on the

works published or accepted for publication in the international scientific reviews with reviews from the official list of the ministry in charge of science.
The manner and the procedure for the preparation and defense of dissertation is regulated with the general by law of the higher education institution which defines the acceptance of the dissertation topic, the grade of the dissertation and fulfillment for access to the public oral defense.

10. Teaching staff

10.1 First and second level of higher education

The teaching staff is recruited for the implementation of the study program with necessary scientific, artistic and professional qualifications. The number of teachers corresponds to the requirements of the study program and depends on the number of courses and number of lessons. The total number of teachers must suffice to cover the total number of lessons in the study program, so that a teacher has 180 lesson of active teaching (teaching, consultation, practice, practical work and field work) on average p.a., namely 6 lessons a week. Of the total number of needed teachers at least 70% must have a permanent employment contracts, full time, and for the study program in the field of art minimum 50%. The realization of study programs of professional studies except in the field of art, requires at least 50% of teachers with Ph.D.

The number of associates corresponds to the needs of the study program and depends of the number of courses and lessons. The total number of associates at the study program must be sufficient to cover the total number of lessons on that program so that the associates have on average 300 lessons of active teaching p.a., namely 10 lessons a week, except in the field of art.

The science and professional qualifications of the teaching staff shall correspond to the education and scientific field and the level of their responsibilities. A teacher must have at least five references in the narrow science, art namely professional area concerned.
The data about the teachers and associates (CV, election to functions, references) must be available to the public.

10.2 Doctoral studies

For the realization of the study program of doctoral dissertation there is teaching staff with the necessary scientific capacities. The higher-education institution which delivers the doctoral dissertation should have:

- defined selection criteria for teachers under permanent employment contract who have full time contract in a higher education institution and developed system of

selection of teachers from other scientific institutions who take part in the delivery of doctoral studies;

- teachers capable of teaching at the doctoral studies proven by the list of works (10 major works) and the data on the participation in the national and international scientific research projects, and has at least one scientific works published or accepted for publication in scientific magazines of the related area of the study program;
- minimum half of the teaching staff involved in science research projects.

Mentor has at least five scientific works published or accepted for publication in scientific magazines of the related area of the study program from the list of the ministry in charge of science in the last 10 years. Mentor may attend to maximum five candidates for a doctor at the same time. The minimum number of teachers who take part in the study program of the doctoral studies with the permanent employment contrast is five. Of the total number of teachers 50% are under permanent employment contact with the higher education institution.

11. Organizational and material resources

11.1 First and second level of higher education

For the realization of a study program adequate human, spatial, technical, library and other resources shall be provided, adequate to the character of the study program and the anticipated number of students. The higher education institution shall ensure adequate premises for the performance of study program, namely the building with at least 4 sq meters gross per student, namely 2 sq m for teaching in shifts, except in the field of arts. The higher-education institution shall have amphitheaters, classrooms. laboratories or similar teaching premises, a library or similar premises for teaching, library and reading rooms as appropriate for study program, adequate to the given education scientific namely artistic fields. The higher-education institution ensures a place in the amphitheatre, classroom and laboratory for every student attending the study program.

The higher-education institution ensures all needed technical equipment for modern teaching activities. The library shall have minimum 100 library units relevant to the study program of the higher education institution. The higher-education institution shall ensure the coverage of all the courses by adequate textbooks, teaching media and aids, available timely and in sufficient numbers for normal development of teaching process of that study program.
For the implementation of study program the necessary IT shall be provided.

11.2 Doctoral studies

The delivery of study program is secured by suitable human resources, premises, technical and technological equipment, librarian and other facilities adequate to the character of doctoral study program and the number of students admitted. The higher-education institution has short term and long term plan and budget for the realization of science research work.

The resources for the implementation of doctoral studies may be provided in cooperation with other higher education institutions, accredited scientific institutions and international organizations. The higher-education institution provides the students with equipment or access to the equipment needed in science research, owned by the higher education institutions to be documented with a list of equipment with corresponding characteristics.
The higher-education institution ensures the use of equipment by the students or access to the equipment necessary in science research under contract on cooperation with other respective organizations.

The higher-education institution provides the access to the library and the use of library resources from own and other sources (books, monographs, scientific magazines, other periodicals) in the volume needed for the realization of the program of doctoral studies. The students at the doctoral studies have the access to the data bases necessary for making the doctoral dissertation and for science research work.
Adequate space is secured for delivery of teaching under the study program, suitable laboratories for experimental work and equipment based on contemporary ICTs.

12. Quality control

12.1 First and second level of higher education

The quality control of the study program shall be regularly carried out by means of self assessment and external quality tests. Quality control of the study program means regular and systematic follow up of its implementation and measures for quality enhancement in terms of curricula, teaching, teaching staff, grading of students, textbooks and literature. Quality control of the study program is carried out in the period set in advance which is three years in the case of self-assessment, and maximum five years for quality control. Quality assessment of the study program involves an active role of students and their appraisal of quality of the program.

12.2 Doctoral studies

Every study program of the higher education institution regularly and systematically controls the quality via self-assessment and external quality reviews. Quality control of the study program entails regular and systematic follow-up, control of quality and taking the measures

for improvement in the following segments: curriculum, teaching, teachers and associates, grading of students, text books and literature. Quality control of the program is carried out periodically as stipulated in the Law. Study program quality control provides for the active role of students and their assessment of quality of program.

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