

Introducing Humanitarian Engineering Concepts to the Curriculum of Telecommunications at Maritime University

Andrzej Borys

Abstract—This paper describes a “distributed method” of introducing the humanitarian engineering principles and concepts to the curriculum of telecommunications at a maritime university. That is by modifying appropriately the syllabi of the telecommunications subjects taught. The propositions made in this area are illustrated by the concrete examples taken from the current Polish Qualifications Framework for the higher education system in Poland. And, for clarity and consistency of presentation, fundamentals and principles as well as a basic terminology and features of this Framework are also highlighted here shortly. Moreover, it has been shown that the approach presented in this paper is more useful compared to a method based on organization of some special courses for students on the humanitarian engineering, in particular when this regards a maritime university.

Keywords—Teaching of humanitarian engineering concepts, curricula and syllabi of telecommunications, implementations within the Polish Qualifications Framework for higher education system in Poland

I. INTRODUCTION

THE humanitarian engineering (HE) is a relatively new idea. It is related with such notions like voluntary service in the engineering profession, volunteerism of engineers for benefit of community as a whole, service-learning approach, and similar ones [1]. And its objective is to help improving the well-being of social groups and communities, which are oft socially marginalized, poor, and not sufficiently serviced by local and governmental authorities. The issue here is not, however, a simple provision of some goods and technologies to the groups and communities mentioned above. It concentrates on other aspects. They can be formulated and expressed shortly as a stimulation of the aforementioned communities to an active participation in the process of seeking and assessment of the solutions for solving their life’s problems. The issue here is to find appropriate solutions for them, and also to develop, jointly, a practical knowledge and knowhow for self-contained coping with similar problems in the future.

Many people and organizations consider nowadays HE as a very import factor in a sustainable development of societies.

The work presented in this paper was supported partly by the grant AMG DS/450/2018.

The author is with the Department of Marine Telecommunications, Faculty of Electrical Engineering, Gdynia Maritime University, Gdynia, Poland, (email: a.borys@we.am.gdynia.pl).

And, because of this reason, they consider that the HE principles and concepts should be reflected - to less or more extent - in the stuff taught at the technical universities, and at all study areas and profiles. That is they should be also taught within telecommunication courses.

Seeing this trend and the society expectations, IEEE Communications Magazine decided to devote one of its special issues to subjects of teaching ideas and concepts of HE and community engagement in the area of telecommunications. Publication of this issue was planned for May 2018. Its announcement in 2017 on the WWW-pages of IEEE Communications Magazine was very impressive. Let us cite it here:

“Feature Topic (FT)

CALL FOR PAPERS

Humanitarian engineering is research and design that aims to directly improve the well-being of poor, marginalized, or under-served communities. A fundamental tenet of humanitarian engineering is the need to engage the community in need and seek their active participation in the development and assessment of appropriate solutions rather than simply provide technology and techniques.

In recent years, several pioneering institutions have begun to incorporate Humanitarian Engineering and Community Engagement principles and concepts into their teaching and research agenda. In so doing, they are helping their students become more globally aware; more conversant with the intersection between economics, sociology, politics and engineering fundamentals; and more engaged with communities in need.

This FT is intended to hasten the incorporation of Humanitarian Engineering and Community Engagement principles and concepts into communications engineering curricula by providing educators, researchers and standards professionals with an opportunity to share their experience, best practices and case studies.

Scope of Submissions

Authors from industry, government and academia are invited to submit papers for this FT of IEEE Communications Magazine on Humanitarian Engineering and Community Engagement in Education. The FT scope includes, but is not limited to, the following topics of interest:

- *Case studies of the incorporation of Humanitarian Engineering and Community Engagement principles and concepts into communications engineering curricula.*

- *Best practices for incorporating Humanitarian Engineering and Community Engagement principles and concepts into communications engineering curricula.*
- *Case studies of the incorporation of Humanitarian Engineering and Community Engagement principles and concepts into professional training.*
 - *Best practices for incorporating Humanitarian Engineering and Community Engagement principles and concepts into professional training.*
 - *Development of tools for use in learning about Humanitarian Engineering and Community Engagement principles and concepts and their impact on design and development.*
 - *Development of humanitarian communication technologies and their use in education.*” – after [5].

The author of this paper responded to the above so nicely formulated call for papers. Fully convinced that this is a really very important topic to commit. And he submitted just this text to IEEE Communications Magazine, and it was initially accepted for publication there.

To his great astonishment, IEEE Communications Magazine cancelled, in about June 2018, its special issue entitled *Education & Training: Humanitarian Engineering and Community Engagement in Education*. And this was a rather amazing thing.

Opposite to this, by this paper, we would like to stress that the scientific community in Poland in general, and at the university of the author of this paper in particular, is continuously interested in the ideas presented above and their implementation in practice. And as just said, one example of such an approach is publication of this work in this journal.

Regarding the topic feature *Humanitarian Engineering and Community Engagement in Education* mentioned above, we restrict ourselves in this paper to its first part. That is to the Humanitarian Engineering (HE) and present some proposals regarding introducing this topic in education of engineers working in the area of telecommunications and the related ones. Here, we concentrate, first, on performing the above task through proper modifications of the existing syllabi of the courses taught. And second, on achievement of the desired results through a proper realization of the modified syllabi' records.

In this article, we refer to as the system of constructing curricula and syllabi that is in place, at present, at the universities in Poland. Moreover, we refer to as the curricula and syllabi that have been developed for teaching telecommunications at a specific university, a maritime university. However, the results and proposals developed here can be also successfully implemented in any other university accreditation system and a university type, in which telecommunications is taught.

At first glance, the task of introducing the HE principles and concepts in the curriculum of telecommunications through relevant provisions in the syllabi of the professional courses like, for example, computer networks, digital modulations and coding, signal processing in telecommunications, information theory, wireless networks and systems etc. may seem a little

bit strange and quite unrealizable. The objective of this paper is to show that such a reasoning is erroneous.

Obviously, one could introduce in the curriculum some special courses devoted exclusively to the HE. And this would seem to be the simplest way. However, it is rather impossible in many cases because it would necessarily be at the cost of resignation for some other important professional courses. Contrary to this, we show here that our method of introducing the HE in the curriculum, sketched above, leads to the same outcomes and results without any need for extension of its time-frames.

The remainder of the paper is organized as follows. In the second section, a short description of the Polish Qualifications Framework is presented. This framework is also illustrated therein by the fragments of four concrete syllabi taken from the sets of syllabi of two Polish universities. In the next section, the propositions of performing some modifications in the definitions of the so-called universal level descriptors occurring in the Polish Qualifications Framework, to take into account the concepts of the HE, are discussed. In the fourth section, example modifications in syllabi for telecommunications courses are briefly described. The next section contains a material on the topic of teaching telecommunications with accordance to the modified syllabi. The paper ends with some conclusions.

II. SHORT DESCRIPTION OF POLISH QUALIFICATIONS FRAMEWORK

A preliminary draft of the European Qualifications Framework (EQF) was published in 2006. And about the same time, preliminary works on its Polish version also started. This framework is called the Polish Qualifications Framework (PQF) and, obviously, it is fully consistent with the ideas, principles, and directives of the EQF. In the recent years, it was fully implemented in the area of Polish higher education. That is also at the Polish technical universities. Nowadays, every curriculum and every syllabus governing teaching at the Polish universities is fully consistent with it. For more details on the PQF, see, for example [2].

The so-called universal level descriptors (ULD) in the EQF and PQF belong to basics of these systems. There are three types of ULDs in them that are named as follows:

1. knowledge (K),
2. skills (S),
3. social competence (SC).

The universal level descriptor K (ULD_K) regards: “scope and depth of understanding: general and selected specific issues relevant to the academic discipline; the legal and economic context of the professional activities typical for the qualifications of a particular study program” as formulated in [2] for the area of higher education.

Further, the universal level descriptor S (ULD_S) regards: “ability to: use attained knowledge to solve complex and non-routine problems and to innovatively perform tasks; communicate with diverse audiences and transfer knowledge; present, evaluate and discuss different positions and opinions;

plan one's own lifelong learning and direct others in this regard" as formulated in [2] for the area of higher education.

And finally, the universal level descriptor SC (ULD_SC) regards: "readiness to: thoroughly analyze and critically evaluate attained knowledge and the achievements of a given discipline; comply with professional ethics and require the same of others; uphold and develop the ethos of the research and artistic communities" as formulated in [2] for the area of higher education.

Fragments of four syllabi showing example formulations of ULDs used in Polish technical universities for courses in the area of telecommunications are presented in Tables I – IV. The first one (Table I) comes from the set of syllabi of the Institute of Applied Informatics of the State University of Applied Sciences (PWSZ) in Elbląg, Poland. It regards the basic course on computer networks. The next three (Tables II – IV) belong to the syllabi set of the courses offered by the Chair of Marine Telecommunications at the Gdynia Maritime University in Gdynia, Poland. They regard more or less specialized courses: on digital modulations and coding, wireless systems and networks, and finally on mobile wireless systems.

TABLE I

Learning outcomes for the course Computer Networks

Course: Computer Networks	
Learning outcomes	
ULD No.	Knowledge
1	Knowledge of basic technologies of computer networks (wired and wireless) and their communication protocols.
2	Knowledge of network topologies and models, and of standards used in the area of computer networks, in particular standards regarding security issues.
3	Practical knowledge of addressing rules used in IP networks.
Skills	
4	Student is capable of designing computer networks in different technologies.
5	Student knows functionalities of different network devices and is capable of exploiting them effectively, and knows principles of their servicing.
6	Student possesses skills to optimize addressing in IP networks according to the rules learned.
7	Student is capable of using proper tools for diagnosis and servicing of a computer network and services offered in it.
8	Student possesses skills useful in analysis and identification of networking problems, skills needed for solving network security problems, and knows how to document correctly events occurring in networks.
Social competences	
9	Student is able to use tools that enable effective and fast communication.
10	Student follows rules of honesty and impeccable manner in network communication.

The example presented in Table I - on the one hand - and the remaining ones in Tables II, III and IV - on the other one -

illustrate two different ways of the use of ULDs. In the first of them, the learning outcomes are formulated in such a manner that the relation between a given outcome and one of the descriptors K, S, and SC is as "one to one". While in the second case, using other formulation causes that the aforementioned relation is as "one to many".

Expressing the above in other words, we see that the learning outcomes are identified with the relevant ULDs in the first case. Therefore, we operate then on only one set of which elements are the ULDs equal to the particular learning outcomes. Contrary to this, in the second case, we need two sets for description. The first one contains elements that are the learning effects (formulated differently as in the first case), and the second set contains the ULDs (also formulated a little bit differently as in the former case). So, to show the relations of the learning effects with the ULDs here, we need a third column as it is visualized in Tables II, III, and IV. Furthermore, Table V explains the definitions of the ULD symbols K_04, K_25, S_01, S_16, and SC_01 used in these tables.

TABLE II

Learning outcomes for the course Digital Modulations and Coding

Course: Digital Modulations and Coding		
Learning outcomes		
LOC No.	Description	Relation with which ULD
1	Student is able to analyze and generate new, more effective digital modulation schemes based on the basic QAM, PSK, and FSK ones.	K_25, S_01, SC_01
2	Student knows how to analyze schemes of reducing inter symbol interferences in which the shaping of transmitted impulses is applied as well as knows how to analyze system schemes using OFDM modulation.	K_25, S_01, SC_01
3	Student is able to analyze code devices generating cyclic codes.	K_25, S_01, SC_01
4	Student is able to analyze code devices generating convolutional codes.	K_25, S_01, SC_01
5	Student is able to analyze decoder devices of convolutional codes.	K_25, S_01, SC_01

What is characteristic in the formulations of the learning outcomes and ULDs used in Tables I – V in the context of HE? We see that all of them, regardless of their constructing manner, are mostly guided by a welfare of a student. She/he has to obtain, for example, a higher level of knowledge of the UMTS system to be able to find a job as telecommunications engineer working for a mobile telephony provider. And with regard to the skills, we have, for instance, such a formulation: "student possesses skills to optimize addressing in IP networks according to the rules learned". That is possessing these skills she/he has good chances to be employed as an computer network administrator. An example of social competence taken from Table IV: "student understands the need for further

Table III

Learning outcomes for the course Wireless Systems and Networks

Course: Wireless Systems and Networks		
Learning outcomes		
LOC No.	Description	Relation with which ULD
1	Student is able to analyze effectively the standards IEEE 802.11 and 802.16 for wireless networks.	K_04, S_01, S_16, SC_01
2	Student knows how to analyze and monitor operation of all the functional blocks of wireless systems Bluetooth and ZigBee.	K_04, S_01, S_16, SC_01
3	Student is able to apply UWB technology.	K_04, S_01, S_16, SC_01

Table IV

Learning outcomes for the course Mobile Wireless Systems

Course: Mobile Wireless Systems		
Learning outcomes		
LOC No.	Description	Relation with which ULD
1	Student knows how to analyze and monitor operation of all the functional blocks of GSM system and its derived subsystems.	K_04, S_01, S_16, SC_01
2	Student knows how to analyze and monitor operation of all the functional blocks of UMTS system and its derived subsystems.	K_04, S_01, S_16, SC_01

studies (graduate and postgraduate ones) and knows advantages of a continuous training (training courses) in strengthening her/his professional qualifications as well as personal and social competences” illustrates once again student-welfare target of her/his studies.

Such an attitude to the goal of studies as described above can be called “self-centered”. It possesses no elements of the ideas standing behind the HE. And maybe this approach was good yet in the 20th century, however, it is not sustainable nowadays. At present, we live in the age of globalization and extreme exploitation of the Earth’s resources. A widespread belief is that both of these phenomena require a new attitude to the engineering in general and to the engineering education in particular. It could be achieved by re-orientation of the one mentioned above to that which could be named “self-and-society balanced”. This would be a mixed (combined) one that takes into account a person’s own welfare together with that of others (in the global scale), and in connection with the Earth welfare.

In the next two sections, we will try to show how to implement the above “self-and-society balanced” approach in

Table V

Descriptions of ULDs occurring in Tables II, III, and IV.

Descriptions of ULDs occurring in Tables II, III, and IV	
ULD No.	Description in [4]
K_04	Student possesses well-ordered and theoretically well-established knowledge in the area of electromagnetic fields and waves, needed for understanding of their generation, wire and wireless transmissions, and also detection of high frequency signals.
K_25	Student possesses necessary knowledge to ensure the safe functioning and proper servicing of electronic, telecommunication, and information systems.
S_01	Student knows how to seek information in the literature, databases, and other sources that she/he needs in her/his studies; moreover, she/he knows how to integrate and assess it, and also to draw correct conclusions, formulate opinions, and justify them.
S_16	Student knows – when formulating and solving tasks related with modeling and design of electronic and telecommunication circuits and systems – how to integrate the knowledge coming from different sources.
SC_01	Student understands the need for further studies (graduate and postgraduate ones) and knows advantages of a continuous training (training courses) in strengthening her/his professional qualifications as well as personal and social competences.

syllabi for telecommunications courses at a maritime university in the Polish system of higher education.

Obviously, the starting point for this task should be a reformulation of the basics of these syllabi - that is of the ULDs in PQF - for taking into account the HE. So, in what follows, we describe first our propositions of complementing the ULDs defined in [2] and referred to as above.

III. PROPOSITIONS FOR REDEFINING ULDs IN PQF

Having in mind the principles and ideas of the HE presented at the beginning of Introduction, we propose here to complement the definition of the ULD_K [2] in the following way: “scope and depth of understanding: general and selected specific issues relevant to the academic discipline; the legal and economic context of the professional activities typical for the qualifications of a particular study program; *usefulness of the attained knowledge for the HE activities; appreciation for necessity of transfer of the attained knowledge voluntarily, within her/his abilities and capabilities, for goals related to the sustainable development of the world*”, where the phrases added are written in italics.

Similarly, our proposition of modifications in the definition of ULD_S [2] has the following form: “ability to: use attained knowledge to solve complex and non-routine problems *as well as problems involved in the humanitarian engineering* and to innovatively perform tasks; communicate with diverse

audiences and transfer knowledge *also voluntarily, depending upon abilities and capabilities held*; present, evaluate and discuss different positions and opinions *also among people coming from other areas than the own one*; plan one's own lifelong learning and direct others in this regard", where the phrases added, as before, are written in italics.

Finally, our relevant propositions regarding ULD_SC definition [2] can be expressed as follows: "readiness to: thoroughly analyze and critically evaluate attained knowledge and the achievements of a given discipline *also with respect to the principles and ideas of the humanitarian engineering*; comply with professional ethics and require the same of others *also in the context of the principles and ideas of the humanitarian engineering*; uphold and develop the ethos of the research and artistic communities *having in mind also the principles and ideas of the humanitarian engineering*", where the phrases added, as in the two previous cases, are written in italics.

Having the ULDs redefined appropriately, we are now able to address, in the next step, the modifications in syllabi to get the ones that take into account the principles of HE.

IV. MODIFICATIONS IN SYLLABI FOR TELECOMMUNICATIONS COURSES

We begin this section with an observation that a maritime university, as, for example, the Gdynia Maritime University, Poland, differs from all the other universities. This is a university inextricably linked to the sea that educates students for the needs of the maritime community. Moreover, this university carries out scientific investigations for the maritime industry and marine governmental institutions. In short, teaching and research at a maritime university are highly sea-oriented. But, the sea means a maritime ethos. And, as we know, this ethos is connected to helping others, the people in need on the sea. It means also rescue voluntarily of survivors by all the ships nearby a shipping disaster or an incident. Seamen show solidarity among themselves and with others.

So, it is obvious that the specific features and traits characterizing the maritime ethos can help in redefining the existing syllabi of the telecommunications courses at a maritime university to make them more HE oriented. In other words, the task formulated above is then easier to perform (at a maritime university).

A scheme to perform the needed modifications in the syllabi for telecommunications courses at a maritime university can be simple, as we will show in what follows. To this end, we will illustrate it with the use of the previous examples of provisions in Tables II, III, IV, and V.

So, we can proceed in the way as follows. We simply remain the records in Tables II, III, and IV unchanged, but carry out the needed changes only in Table V. Note that the changes performed in Table V influence indirectly record meanings of the records of Tables II, III, and IV - through the relations indicated in their third columns.

Let us now present the modified Table V with the changes introduced in accordance with the modified ULDs described in the previous section.

Table VI

Descriptions of modified ULDs occurring in Tables II, III, and IV

Descriptions of modified ULDs occurring in Tables II, III, and IV	
ULD No.	Description in [4] complemented
K_04	Student possesses well-ordered and theoretically well-established knowledge in the area of electromagnetic fields and waves, needed for understanding of their generation, wire and wireless transmissions, and also detection of high frequency signals. <i>She/he is aware of usefulness of this knowledge for HE activities. Moreover, she/he is mentally prepared for its transfer within HE activities.</i>
K_25	Student possesses necessary knowledge to ensure the safe functioning and proper servicing of electronic, telecommunication, and information systems. <i>She/he is aware of usefulness of this knowledge for HE activities. Moreover, she/he is mentally prepared for its transfer within HE activities.</i>
S_01	Student knows how to seek information in the literature, databases, and other sources that she/he needs in her/his studies; moreover, she/he knows how to integrate and assess it, and also to draw correct conclusions, formulate opinions, and justify them, <i>taking also into account the specific needs of HE.</i>
S_16	Student knows – when formulating and solving tasks related with modeling and design of electronic and telecommunication circuits and systems – how to integrate the knowledge coming from different sources, <i>taking also into account the specific needs of HE.</i>
SC_01	Student understands the need for further studies (graduate and postgraduate ones) and knows advantages of a continuous training (training courses) in strengthening her/his professional qualifications as well as personal and social competences. <i>And she/he is aware and fully convinced that she/he does this also to address the needs of HE.</i>

Note that the phrases added in Table VI (compared to Table V) are written in italics.

V. TEACHING TELECOMMUNICATIONS WITH ACCORDANCE TO MODIFIED SYLLABI

Obviously, the fact that one has syllabi adapted and adjusted to the needs of HE - as those, for example, described in the previous section – does not ensure alone teaching and students' education with accordance to the principles and concepts of the HE. This is only the first step. In the second one, the university, faculty or department must ensure syllabi' correct implementation during lectures and students' laboratories, in projects etc. For this task, academic teachers' commitment to the principles and concepts of the HE, their knowledge of the above subjects, and their possible own involvement and engagement in some HE activities are very important.

Achieving a good status regarding these three features and issues mentioned above is rather no problem at a maritime university. This is so because, as raised before, of overwhelming influences of the maritime ethos on the teaching at this type of university. Students here learn much about rescue principles on the sea, how to organize help in the cases of disasters on the sea, how to organize it logistically and technically. They learn that the rescue actions are voluntary and need in many cases much effort from many sides operating on the sea and accompanying organizations on the land. Also, they learn how to coordinate rescue actions. Moreover, the students of a maritime university coming from all its faculties have practical trainings on the university training ships.

To strengthen this good atmosphere at a maritime university described above, which is needed for teaching the principles and concepts of the HE, and to discuss specific topics of the HE in more detail, it is sufficient to organize only a short course for the maritime university teaching staff on these subjects.

So, introducing the HE principles and concepts in the curriculum of telecommunications of a maritime university in a distributed way, as described in this paper, is not too cumbersome and time-consuming. It does not also require new special courses related to the HE to be introduced into the curriculum. And in this context, note that the alternative to our approach would be just an introduction of some special courses devoted exclusively to the HE at the cost of resignation of some professional ones. The results achieved in each of the above methods are, however, the same. This follows from the material presented in all sections of this paper.

VI. PROJECT STATUS

In the fall of 2014, the author of this paper moved from another Polish university to the Gdynia Maritime University in Gdynia, Poland. Here, he became responsible for teaching courses in wireless communications that he did not teach previously. He started this work with overviewing the syllabi of the above courses, which were developed by his predecessor. The objective was to update their contents and possibly to introduce new elements as well. That was for the first time, when he thought about the HE in conjunction with telecommunications, in particular on introduction of the HE concepts in the area of wireless communications. At that time, however, because of a lack of time only the most necessary changes were introduced into the syllabi.

Now, the situation is much more comfortable for the implementation of the ideas discussed in the paper. The reasons for this are the following: different realization details have been worked out, we do not have to focus on any other urgent matters, and finally, in the meantime, the author of this paper was appointed a Head of the Chair of Marine Telecommunications at the Gdynia Maritime University. The latter will enable him to effectively organize introduction of the humanitarian engineering concepts by all the Chair members, who are responsible for the other syllabi constituting the curriculum of telecommunications at the Gdynia Maritime University.

At the Gdynia Maritime University, similarly as in any other Polish university, an introduction of a new course instead of an old one within any field of study needs, first of all, an approval of the program committee, which is responsible for this field. Then, an approving decision of a faculty council must follow.

The author of this paper examined possibilities of introduction of some HE stand-alone courses at the Gdynia Maritime University according to the procedure just mentioned. The aforementioned bodies were rather unwilling to accept this way of introduction of the HE concepts into teaching. The main argument they used was the following: it would be at the expense of teaching of some very important professional subjects. Therefore, they suggested another way of doing the above, by proposing students non-obligatory (optional) courses on the HE concepts. However, at least at the Gdynia Maritime University, the problem with non-obligatory courses is that they do not attract a large audience.

It seems that the “distributed method” of introducing the HE principles and concepts into teaching, which is proposed and discussed in this paper, takes into account the circumstances described above in the best possible way.

In the autumn of 2017, this project started. Now, we are at the stage of introducing relevant supplements related to the HE concepts into all of the syllabi belonging to the telecommunications curriculum. We will finish this task in June 2019. The academic year 2019/2020 will be the first year of teaching telecommunications at the Gdynia Maritime University according to the modified syllabi. Then, our method of introduction of the HE concepts into telecommunications curriculum and results achieved will be evaluated by our internal commission as well as by an external accreditation body (in Poland evaluations by external bodies are performed every six years).

We will set up a monitoring and assessing program for this project soon. In its assessing part, we will prepare appropriate tools for an evaluation of the effectiveness of the approach we propose here. These tools will be primarily appropriately prepared questionnaires for students and teachers. We hope to receive from outcomes of these questionnaires useful information. For example, we will be interested in reception of students to the introduction of HE topics, in students' comments and/or feedback on how they perceive the importance of the HE as a part of telecommunications curriculum, in influence of the HE concepts learned on student's own development and self-paced learning later in her/his studies, and in many other matters suggested by the reviewers of this paper. We find all of their suggestions regarding the project assessment very valuable.

Regarding the problem of evaluation of the effectiveness of the proposed method against the organization of HE-specific courses, we will try to contact those universities, which realize introduction of the HE concepts into teaching by organizing stand-alone courses devoted to these topics, to establish an exchange of information. We hope to obtain useful results by carrying out a comparative study of our data with their ones.

VII. CONCLUSIONS

In this paper, we have proposed introducing humanitarian engineering concepts to the curriculum of telecommunications at maritime university through performing appropriate modifications of the relevant syllabi. The propositions presented have been illustrated by some examples taken from the implementation of the Polish Qualifications Framework at the Gdynia Maritime University. We hope that these examples and some outcomes discussed here are convincing. Also, we hope that the propositions presented in this paper will be applied at other universities in the world (not only at the maritime ones).

REFERENCES

- [1] K. M. Passino, "Educating the Humanitarian Engineer," *Science and Engineering Ethics*, 2009, vol. 15, pp. 577–600.
- [2] S. Sławiński *et al.*, *The Polish Qualifications Framework: User's Guide*, Educational Research Institute: Warsaw, 2017; also November 18, 2017; www.kwalifikacje.edu.pl/download/publikacje/PQF_UG.pdf.
- [3] ----, "Programy kształcenia," November 18, 2017; <http://www.pwsz.elblag.pl/iis-programy-ksztalcenia.html> (in Polish).
- [4] ----, "Efekty kształcenia dla kierunku studiów Elektronika i Telekomunikacja prowadzonych na Wydziale Elektrycznym Akademii Morskiej w Gdyni," November 18, 2017; <http://www.am.gdynia.pl/sites/default/files/files/Efekty%20ksztalcenia%20Elektronika%20i%20Telekomunikacja1.pdf> (in Polish).
- [5] ----, WWW-pages of *IEEE Communications Magazine* in 2017; <https://www.comsoc.org/commag/call-for-papers>.