MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

APPROVED

by Head of Academic Council
Igor Sikorsky Kyiv Polytechnic Institute

_____ Mykhaylo ILCHENKO

«____»_____2021 p.

EDUCATIONAL AND PROFESSIONAL PROGRAM

Electronic Components and Systems

Level of higher education	**second (master's) level**
Speciality	**171 Electronics**
Qualification	**Master in Electronics**

APPROVED by Academic Council of university

protocol No ___ from «__»_____2021

Igor Sikorsky Kyiv Polytechnic Institute
Kyiv – 2021

PREFACE

DEVELOPED by project group:

Guarantor of educational program
Ievgen VERBITSKY
PhD, Assistant Professor of Department of Electronic Devices and Systems _____

Iuliia YAMNENKO
DrSc, Professor, Head of Department of Electronic Devices and Systems _____

Kateryna KLEN
PhD, Assistant Professor of Department of Electronic Devices and Systems _____

APPROVED:

by Scientific-Methodological Commission of Igor Sikorsky Kyiv Polytechnic Institute by specialty 171 Electronics

Head of Scientific-Methodological Commission _____ Iuliia YAMNENKO
(protocol No ___ from «__»_____2021)

by Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute
Head of Methodological Council _____ Yuriy YAKYMENKO
(protocol No ___ from «__»_____2021)

TAKEN INTO ACCOUNT:

- N. Ilyina, deputy. director, L. Litvinenko, head. specialist of PE "TORNADO-O";
- V. Permyakova, director of ITL LLC;

Response, reviews and support letters from stakeholders are attached.

Because of the approval of the Standard of Higher Education in the specialty 171 Electronics for the second (master's) level of higher education by the order of the Ministry of Education and Science of Ukraine dated 30.04.2020 № 580, the educational program (EP) was monitored.

According to the results of monitoring the educational and professional program "Electronic components and systems" of the second (master's) level of higher education in specialty 171 Electronics, approved by the Academic Council of 02.04.2018, protocol №4, taking into account the proposals of participants in the educational process, proposals of graduates, employers and other external stakeholders, its modernization was carried out.

The project team reviewed the balance, rational use of credits, the ability of students to master certain disciplines (educational components) and the entire EP, investing in a certain time, the completeness of documentary, personnel, information and other support of EP and its compliance with the License Conditions.

To ensure the possibility of forming an individual educational trajectory, including the opportunity of the individual choice of academic disciplines in the amount provided by law, and in order to ensure compliance with the Standard of Higher Education, it was decided to transfer some disciplines to selective blocks, modernize their content, offer a list of disciplines to the cathedral F-Catalog.

The educational and professional program "Electronic components and systems" was discussed and approved by research and teaching staff at a meeting of the Department of Electronic Devices and Systems (protocol №14 from 21.01.2021).

Scientific and methodical commission of KPI named after Igor Sikorsky of 171 Electronics speciality, considered and approved changes in the EP (protocol № 4 of February 2, 2021).

CONTENT

1. PROFILE OF EDUCATIONAL PROGRAM

1 – General characteristics	
Full name of university and Institute/Faculty	National Technical University of Ukraine ”Igor Sikorsky Kyiv Polytechnic Institute”, Faculty of Electronics
Level of higher education and qualification	Level of higher education – Master Qualification – Master in Electronics
Official name of EP	Electronic Components and Systems
Type of diploma and duration of study	Master’s diploma 1 year 4 months
Presence of accreditation	Certificate of accreditation of the specialty НД 1192632, valid until 01.07.2023
Cycle/level of higher education	National Frame of Qualifications of Ukraine – level 7 QF-EHEA – cycle 2 EQF-LLL – level 7
Pre-requisites	Bachelor level
Languages of study	Ukrainian, English
Expiring date	Till next revision
Link or permanent placement of EP	https://osvita.kpi.ua/op http://eds.kpi.ua/?page_id=5040
2 – Goals of study	
Training of a specialist in the conditions of labor market transformation, able to develop the latest and use existing technologies, devices and electronics systems in scientific institutions and leading enterprises of the industry in order to ensure sustainable innovative scientific and technical development of society. The purpose of EP corresponds to the development strategy of Igor Sikorsky KPI for 2020-2025 on the formation of the future society on the basis of the concept of sustainable development.	

3 – Description of subject area	
Subject area	**Object of activity** is physical processes and phenomena, algorithms and systems of control, topological and software solutions that create the basis of functioning of microprocessor and computer, informational and power converting electronic systems. **Goals of study** is acquisition of competencies needed to solve complex problems and problems in the field of electronics, including through research and innovation. **Theoretical content** of subject area is fundamental principles, concepts of construction, modeling, optimization of modern electronic components and systems. **Methods, techniques and technologies** for measuring and modeling the characteristics of electronic components, devices, equipment, systems; planning experiments and processing their results; substantiation of circuit and software solutions; modern multimedia, computer and information technologies, electronic industry technologies. **Tools and equipment -** electronic components, devices, devices and systems, control and measuring equipment, control and regulation systems, power supply of electronic equipment, display and registration of information, computer and microprocessor technology, specialized software.
Orientation of EP	Educational and professional
The main focus of EP	Educational and professional. Special education in electronics, in particular, industrial and power electronics, analog and digital circuitry, converter and microprocessor technology, electronic components and systems with the acquisition of research skills for scientific and professional careers. Aimed at developing the applicant's ability to identify and solve complex problems in the field of knowledge "17 Electronics and Telecommunications". **Key words**: power electronics, industrial electronics, analog circuitry, digital circuitry, electronic systems, electronic technological equipment.
Features of EP	The implementation of the program involves the involvement of specialists and experts in the field of power and information electronics, as well as representatives of stakeholders. Students have the opportunity to study double degree programs with the Technical University of Dresden (Germany), the Korean Institute of Science and Technology (South Korea) and other foreign universities with which there are relevant agreements.
4– Suitability of graduates for employment and further study	

Suitability for employment	According to the State Classification of Occupations DK 003: 2010 graduates can work in the following positions: 2143 Professionals in the field of electronics - Engineer on relay protection and electrical automation - Engineer of converting complex 2144 Professionals in the field of electronics and telecommunication - Engineer in the field of electronics and telecommunication - Engineer on sound recording - Engineer on electronics - Engineer on electronic systems of manufacturing of non-traditional and renewable energy sources - Engineer on design (electronics) 2149 Professionals in other fields of engineering – Engineer – Engineer on control of gas accounting systems – Engineer on tune-up and testing (in electronics) – Engineer on standards and quality – Engineer on exploitation and repair (in electronics)
Further education	The Master of Electronics has the right to master the programs of Doctor of Philosophy in Electronics and interdisciplinary programs close to electronics (automation, instrumentation, telecommunications, radio engineering and others).

5 – Teaching and study	
Teaching and learning	General learning style is task-oriented. Teaching is carried out in the form of: lectures, seminars, practical classes, laboratory classes, independent work with the opportunity of consultation with the teacher, individual classes, application of information and communication technologies (e-learning, online lectures, OCW, distance learning courses) for individual educational components: - Lections, practical and seminar lessons, computer practicum, laboratory and calculation works, practices, interactive workshops – in auditorium, distant or combined format; - Auditorium lessons with involvement of professionals in the field of electronics, including the study at the territory of partner enterprises; - Participation in scientific and technical international and inter-disciplinary conferences, seminars, projects, trainings; - Individual work with the use of methodological and scientific information sources; - Participation in work groups on developing the research projects; - Consultations with scientific and pedagogical staff. The study is finished by writing and public defense of qualification thesis – Master dissertation.
Assessment	Assessment of students' knowledge is carried out in accordance with the Regulations on the system of assessment of learning outcomes in Igor Sikorsky KPI for all types of classroom and extracurricular work (current, calendar, semester control); oral and written exams, tests.
6- Program competencies	
Integral competence	Ability to solve complex specialized tasks and practical problems of professional activity in the field of electronics and / or in the learning process, which involves research and / or innovation in the field of electronics and characterized by complexity and uncertainty of conditions and requirements.
General competencies (GC)	
GC 1	Ability to abstract thinking, analysis and synthesis
GC 2	Ability to communicate in the state language both orally and in writing
GC 3	Ability to communicate in a foreign language
GC 4	Ability to perform research at the appropriate level
GC 5	Ability to search, process and analyze information from various sources
GC 6	Ability to generate new ideas (creativity)
GC 7	Interpersonal skills
GC 8	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity)
Professional competencies (PC)	
PC 1	Ability to assess the level of existing technologies in the field of professional activity, the effectiveness of technical solutions
PC 2	Ability to plan and implement innovative projects in the field of electronics, protect intellectual property rights
PC 3	Ability to systematically solve problems of development, analysis, calculation, modeling of electronic power, information, control and multimedia systems
PC 4	Ability to use information, computer and multimedia technologies, methods of modeling, intellectualization, artificial intelligence, experimental methods for research and analysis of processes in electronic systems

PC 5	Ability to ensure the efficiency and quality of measurements in electronic systems
PC 6	Ability to find the necessary information with the help of modern information resources, analyze and evaluate it
PC 7	Ability to solve problems of processing and displaying information in modern electronic systems
PC 8	Ability to design and tune electronic devices and systems using modern software and measuring equipment
PC 9	Ability to integrate electronic devices and systems into the Internet space using the concept of the Internet of Things
PC 10	Ability to assess problem situations in the field of development, design, tune-up, functioning and operation of electronic systems, to formulate proposals for solving problems.
PC 11	Ability to take into account in design and technological, engineering and scientific and technical solutions requirements for safety of life, protection of intellectual property, energy efficiency and environmental friendliness
Program results of education	
R1	Implement projects for modernization of production and technologies in the field of electronics, introduction of the latest information and communication technologies, multimedia
R2	Model and experimentally study phenomena and processes in electronic devices and systems, in technologies of the electronic industry
R3	To cooperate with the customer in the formulation of the technical task and discussion of technical solutions and results of projects, to lead a reasoned professional and scientific discussion
R4	Develop low-waste, energy-saving and environmentally friendly technologies taking into account the requirements of human safety, rational use of raw materials, energy and other resources
R5	Ensure energy and economic efficiency of development, production and operation of electronic equipment
R6	Ensure professional development of team members taking into account the world level of scientific and engineering achievements in the field of development and operation of electronic systems
R7	Carry out information and scientific research using scientific, technical and reference literature, databases and knowledge, other sources of information; critically comprehend and interpret existing knowledge and data, form directions of research and development taking into account domestic and foreign experience
R8	Carry out and coordinate the development, selection, use and modernization of the necessary equipment, tools and methods in the organization of the production process, taking into account technical and technological capabilities, modern science-intensive methods, tools and technical solutions
R9	Coordinate the work of teams of performers in the field of research, design, development, analysis, calculation, modeling, production and testing of electronic devices and systems
R10	Choose the best research methods, modify, adapt and develop new methods
R11	Analyze technical and economic indicators, reliability, ergonomics, patent purity, market requirements, investment climate and compliance of design solutions, research and development with certain goals and norms of the legislation of Ukraine
R12	To generalize modern scientific knowledge in the field of electronics and apply them to solve complex scientific and technical problems, bringing the obtained solutions to the level of competitive developments, implementation of results in business projects

R13	Organize and manage research, innovation and investment activities, business projects and production processes taking into account technical, technological and economic factors
R14	Apply in practice modern methods and tools for designing and debugging electronic equipment
R15	Integrate electronic devices and systems into the digital environment, organize the exchange, accumulation and processing of information

8 – Resource support for program implementation

Staff base	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 dated 10.05.2018.
Material and technical base	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 dated 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform, demonstration industry equipment during laboratory workshops.
Informational and methodological base	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of HE (Annex 5 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 from 10.05.2018. Use of the Scientific and Technical Library of Igor Sikorsky KPI.

9 – Academic mobility

National credit mobility	Possible, subject to corresponding agreements between Igor Sikorsky Kyiv Polytechnic Institute and Ukrainian universities
International credit mobility	Realized on the base of agreements about international academic mobility (Erasmus+ K2). Program of double diploma with Technical University of Dresden and South Korea Institute of Science and Technology.

3. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Educational components	ECTS Credits	Form of final control
1	2	3	4
1. Compulsory educational components			
1.1. General training cycle			
CG 1	Intellectual and Patenting Property	3	Final test
CG 2	Foundations of sustainable development (Основи сталого розвитку)	2	Final test
CG 3	Practice on Foreign Language Scientific Communication	3	Final test
CG 4	Startup Projects Marketing	3	Final test
1.2. Vocational training cycle			
VC 1	Electronic Systems for Operation and Control	5	Exam
VC 2	Course Project in Electronic Systems for Operation and Control	1,5	Final test
VC 3	Fundamentals of Automatic Control Theory	5	Exam
VC 4	Power Electronic Systems	6	Exam
VC 5	Power Supply Systems of Electronic Equipment	5	Final test
VC 6	Scientific Research	7,5	Final test
VC 7	Scientific and Research Practice	14	Final test
VC 8	Master Thesis	12	Defence
2. Optional educational components			
2.1. Vocational training cycle (Optional subjetcs from Faculty catalogue)			
VO 1	Educational components 1 Faculty catalogue	5	Exam
VO 2	Educational components 2 Faculty catalogue	4	Final test
VO 3	Educational components 3 Faculty catalogue	5	Exam
VO 4	Educational components 4 Faculty catalogue	5	Exam
VO 5	Educational components 5 Faculty catalogue	4	Final test
TOTAL IN **General training cycle**:		67	
TOTAL IN **Vocational training cycle**:		23	
The amount of educational components that ensure the acquisition of competencies of certain SVO:		41	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**90**	

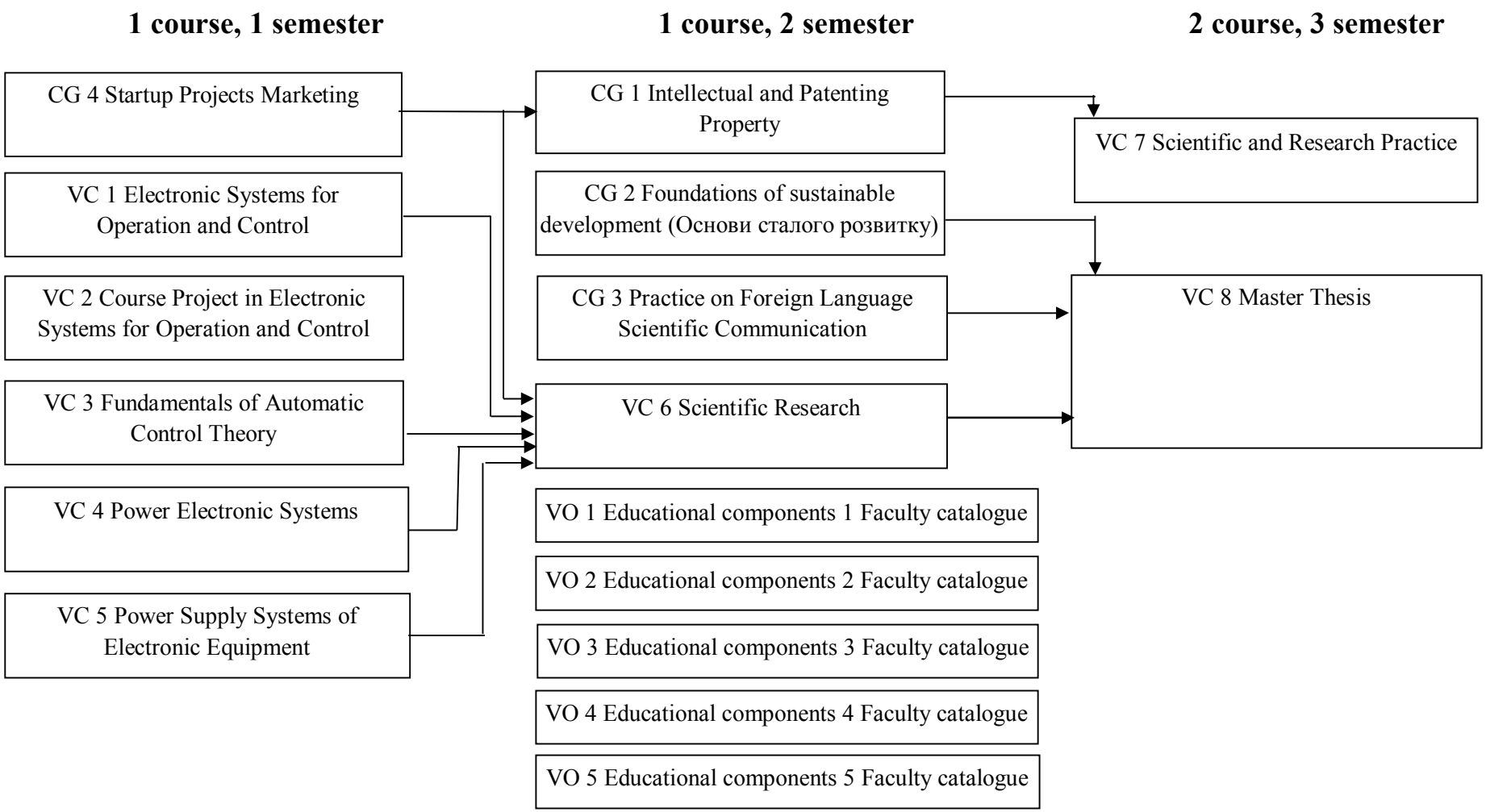
Designations and abbreviations are given in the table:

CG – Compulsory educational component of General training cycle.

VC – Compulsory educational component of Vocational training cycle.

VO – Optional educational components of Vocational training cycle.

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Attestation of applicants for higher education in the educational program is carried out in the form of public defense of the master's dissertation and ends with the issuance of a standard document on awarding a master's degree with a qualification: master of electronics in the educational-professional program "Electronic Components and Systems".

Certification is carried out openly and publicly. The master's dissertation is checked for plagiarism.

5. MATRIX OF CONFORMITY OF PROGRAM COMPETENCES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	CG 1	CG 2	CG 3	CG 4	VC 1	VC 2	VC 3	VC 4	VC 5	VC 6	VC 7	VC 8
GC 1				+	+		+	+	+	+		+
GC 2	+									+		+
GC 3		+	+									
GC 4	+									+		
GC 5	+	+										+
GC 6	+			+						+		
GC 7				+							+	
GC 8			+								+	
PC 1	+			+	+			+	+	+	+	+
PC 2	+			+				+				
PC 3					+	+	+			+		
PC 4					+	+	+	+	+		+	
PC 5							+	+	+			
PC 6	+				+	+	+		+	+		+
PC 7					+	+			+			
PC 8						+		+	+			
PC 9					+		+					
PC 10							+	+				
PC 11					+			+		+	+	+

6. MATRIX OF PROVIDING PROGRAM LEARNING RESULTS BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	CG 1	CG 2	CG 3	CG 4	VC 1	VC 2	VC 3	VC 4	VC 5	VC 6	VC 7	VC 8
R 1			+		+			+	+		+	
R 2					+	+	+	+				+
R 3	+			+						+	+	+
R 4		+	+		+	+	+	+	+	+		
R 5		+		+	+		+	+				
R 6	+					+				+	+	
R 7	+									+		+
R 8								+		+		
R 9				+						+		
R 10	+				+		+			+		
R 11	+			+						+		
R 12				+	+		+	+				
R 13			+	+							+	
R 14					+			+	+			
R 15					+	+						

6. FORM OF FINAL ATTESTATION OF STUDENTS

The final attestation of students in the educational program is conducted in the form of public defense of the Master Thesis and ends with the issuance of a standard document on awarding a master's degree and qualification “Master in Electronics” in the educational program "Electronic Components and Systems".

Final attestation is carried out openly and publicly. Master Thesis checked for plagiarism.

7. INTERNAL QUALITY ASSURANCE SYSTEM OF HIGHER EDUCATION

In the Igor Sikorsky Kyiv Polytechnic Institute functioning system of higher education quality education and quality of higher education (internal quality assurance system), which provides for such procedures and measures:

1) defining the principles and procedures for ensuring the quality of higher education;
2) monitoring and periodic review of educational programs;
3) annual evaluation of students, research and teaching staff of higher education institutions and regular publication of the results of such evaluations on the official website of the Higher Education Institution, on information stands and in any other way;
4) providing advanced training of pedagogical, scientific and scientific-pedagogical workers;
5) ensuring the availability of the necessary resources for the organization of the educational process, including independent work of students, for each educational program;
6) ensuring the availability of information systems for effective management of the educational process;
7) ensuring publicity of information about educational programs, higher education degrees and qualifications;
8) ensuring compliance with academic integrity by employees of higher education institutions and students, including the establishment and operation of an effective system for the prevention and detection of academic plagiarism;
9) other procedures and measures.

The system of providing higher education institutions with the quality of educational activities and the quality of higher education (internal quality assurance system) is assessed by the National Agency for Quality Assurance in Higher Education or its independent accredited quality assessment and quality assurance institutions for compliance with the requirements of the assurance system. quality of higher education, approved by the National Agency for Quality

Assurance in Higher Education, and international standards and recommendations for quality assurance in higher education.

8. LIST OF REGULATORY DOCUMENTS ON WHICH THE EDUCATIONAL PROGRAM IS BASED

Official documents:

1. ESG 2015 (Standards and Guidelines for Quality Assurance in the European Higher Education Area) – https://ihed.org.ua/wp-content/uploads/2018/10/04_2016_ESG_2015.pdf
2. EQF 2017 (European Qualifications Framework) – https://publications.europa.eu/en/publication-detail/-/publication/ceead970-518f-11e7-a5ca-01aa75ed71a1/language-en; https://ec.europa.eu/ploteus/content/descriptors-page
3. QF EHEA 2018 (The framework of qualifications for the european higher Education area) – http://www.ehea.info/Upload/document/ministerial_declarations/EHEAParis2018_Communique_AppendixIII_952778.pdf
4. ISCED (International Standard Classification of Education) 2011 – http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf ; http://uis.unesco.org/en/topic/international-standardclassification-education-isced
5. ISCED-F (International standard classification of education, Fields of education and training) 2013 – http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-fields-of-education-and-training-2013-detailed-field-descriptions-2015-en.pdf
6. Law "On Higher Education"– https://zakon.rada.gov.ua/laws/show/1556-18.
7. Law "On Education"– https://zakon.rada.gov.ua/laws/show/2145-19.
8. National Classifier of Ukraine: Classifier of professions ДК 003:2010. – https://zakon.rada.gov.ua/rada/show/va327609-10
9. National qualifications framework, 2019 – https://zakon.rada.gov.ua/laws/show/1341-2011-%D0%BF.
10. List of fields of education and training and specialties 2015 – https://zakon.rada.gov.ua/laws/show/266-2015-%D0%BF.
11. Decree of the President of Ukraine "Issues of European and Euro-Atlantic integration" of April 20, 2019 № 155/2019 – https://www.president.gov.ua/documents/1552019-26586

12. Resolution of the Cabinet of Ministers of Ukraine “On approval of the Procedure for training students for the degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions)” № 261 of March 23, 2016 https://zakon.rada.gov.ua/laws/show/261-2016-%D0%BF

13. Order of the Ministry of Education and Science of Ukraine dated "01" June 2016 № 600 (as amended by the order of the Ministry of Education and Science of Ukraine dated 01.10.2019 № 1254) "On approval and implementation of Guidelines for the development of standards of higher education". http://edu-mns.org.ua/img/news/8635/NakMON_1254_19.pdf

Other recommended sources:

1. Tuning Educational Structures in Europe. http://www.unideusto.org/tuningeu/

2. National Glossary: Higher Education, 2014 – http://erasmusplus.org.ua/korysna-informatsiia/korysni-materialy/category/3-materialynatsionalnoi-komandy-ekspertiv-shchodo-zaprovadzhennia-instrumentiv-bolonskohoprotsesu.html?start=80

3. Rashkevych Yu.M. The Bologna Process and a New Paradigm of Higher Education: Monograph – https://erasmusplus.org.ua/korysna-informatsiia/korysni-materialy/category/3-materialy-natsionalnoi-komandy-ekspertiv-shchodo-zaprovadzhennia-instrumentiv-bolonskoho-protsesu.html?download=82:bolonskyi-protses-nova-paradyhma-vyshchoi-osvity-yu-rashkevych

4. Development of educational programs: methodical recommendations – http://erasmusplus.org.ua/korysna-informatsiia/korysni-materialy/category/3-materialynatsionalnoi-komandy-ekspertiv-shchodo-zaprovadzhennia-instrumentiv-bolonskohoprotsesu.html?start=80