HISTORY OF SCIENCE AND TECHNOLOGY (GN 2)

Course syllabus (Syllabus)

Course details

Level of higher education *First (bachelor's)*

Field of knowledge	*17 Electronics, Automation, and Electronic Communications*
Special	*172 Electronic Communications and Radio Engineering*
Educational program	*Intelligent technologies of radio electronics*
Status of the discipline	*Mandatory*
Form of study	*Full-time (day)*
Year of training, semester	*1st year, spring semester*
Scope of the discipline	*2 ECTS credits/60 hours (lectures – 18 hours, seminars – 18 hours, SR – 24 hours)*
Semester assessment/assessment measures	*Module test, credit*
lesson schedule	*Lectures (once every two weeks starting from week 1)* *Seminar lessons (once every two weeks, preferably after the lecture)*
Language of instruction	*Ukrainian*
Information about the course leader/teachers	*Lecturer: Associate Professor, Candidate of Historical Sciences, Associate Professor of the Department of History* ***Lyudmila Ignatova*** Ignatova.Lyudmila@lll.kpi.ua , 050 576 86 70 *Seminar: Associate Professor, Candidate of Historical Sciences, Associate Professor of the Department of History* ***Lyudmila Ruslanivna Ignatova*** Ignatova.Lyudmila@lll.kpi.ua , 050 576 86 70 *https://history.kpi.ua/department/academic-staff/*
Course placement	Courses are hosted on the Sikorsky distance learning platform using Moodle https://do.ipo.kpi.ua/course/view.php?id=4214ye27fd

Curriculum

1. Description of the academic discipline, its purpose, subject matter, and learning outcomes

The academic discipline "History of Science and Technology" is developed on the basis of a combination of humanities and natural sciences knowledge, and therefore, unlike the" lesson schemes" developed in the past and focused mainly on the history of natural sciences and technology, it aims to cover all forms of scientific knowledge – natural, technical, and humanities. The study of this academic discipline is an important means of shaping students' scientific worldview, promoting the growth of their general erudition, and is also an integral part of the normative educational components of the general training cycle studied at Igor Sikorsky KPI.

The syllabus for the academic discipline "***History of Science and Technology***" is developed on the basis of the principle of constructive alignment, which makes it possible to predict the necessary learning tasks and activities that students need to achieve the expected learning outcomes and to plan the learning process in such a way as to maximize the opportunities for students to achieve the desired results.

The subject of the discipline "History of Science and Technology" is the genesis and patterns of the formation and development of world science and technology, the history of human activity in the scientific and technical sphere from ancient times to the present day in close connection with global historical and cultural processes. "History of Science and Technology" is a dynamically developing science that is constantly replenished with new knowledge, scientific concepts, and facts.

The aim of the discipline is to give students an understanding of the main stages, processes, and events in the history of the development of science and technology from ancient times to the present day and to form a holistic view of the development of science and technology as a historical and cultural phenomenon; to familiarize students with the history accumulation of scientific knowledge in specific fields of natural sciences, social sciences, humanities, and technical sciences in accordance with specific historical stages of human development.

In accordance with the educational and professional programs (PP) of the first "bachelor's" level of higher education, after studying the discipline, students should acquire **the** following **competencies**:

04 Knowledge and understanding of the subject area and understanding of professional activity

SC 12 Ability to preserve and multiply the moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technologies, use various types and forms of physical activity for active recreation and a healthy lifestyle.

According to the first "bachelor's" level of higher education, as a result of mastering academic discipline, students must demonstrate **the** following **program learning outcomes**:

PRN 05 Skills in evaluating, interpreting, and synthesizing information and data.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

In the structural-logical schemes of educational and professional programs for training specialists of the first (bachelor's) level of higher education, the academic discipline "History of Science and Technology" is included in the list of normative disciplines aimed at forming the general competencies of a specialist.

Prerequisites – the academic discipline is interdisciplinary in nature and is taught in the second semester of the first year of the first (bachelor's) level of higher education. In the structural-logical scheme of the educational program, the discipline "Ukrainian language for professional purposes" is a prerequisite.

Post-requisites - this academic discipline develops students' skills/abilities to preserve and multiply the moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area of the corresponding educational program of the first (bachelor's) level of higher education; post-requisites are the discipline "environmental protection strategy."

It is an integral part of the first (bachelor's) level of higher education.

3. Contents of the academic discipline

Section 1. Historical aspects of the development of science and technology in the agrarian era.

Topic 1.1. Introduction. Theoretical and methodological foundations of the "History of Science and Technology."

Topic 1.2. Accumulation of knowledge, techniques, and technologies in prehistoric times and the era of ancient civilizations.

Topic 1.3. Technology in the Middle Ages. Scientific knowledge in the 16th-18th centuries.

Section 2. Scientific thought and technological capabilities of humanity in the industrial era.

Topic 2.1. Development of technology and scientific knowledge in the mid-18th – 1870s.

Topic 2.2. New discoveries in physics, mathematics, and natural sciences at the turn of the 19th-20th centuries.

Topic 2.3. Development of technology in the early 20th century and during World War I.

Section 3. Key trends in the development of science and technology in the information age.

Topic 3.1. World science and technology in the 1920s-1940s.

Topic 3.2. Development of science and technology in the second half of the 20th century and early 21st century. Topic 3.3 History of the emergence and development of engineering education and technical sciences. Summary of the course.

Teaching materials and resources

Basic and additional literature (hereinafter referred to as literature) is used to prepare for lectures, seminars, Module test s (consisting of three parts), independent work, etc. The literature required for mastering discipline is studied by students independently using Internet resources, on the Sikorsky distance learning platform using the Moodle platform. In the context of distance learning, students can use literature available in electronic form on university and external media.

3.1 Basic literature.

1. Besov L.M. Science and technology in the history of society: textbook. / L.M. Besov; Ministry of Education and Science, Youth and Sports of Ukraine, National Technical University "Kharkiv Polytechnic Institute." – Kharkiv: Golden Pages, 2011. - pp. 13-19, 22-32, 32-37, 38-88, 89-115, 123-132, 132-134, 136-142, 149-164, 165-237, 238-242, 242-265, 266-290, 294-333, 334-365, 366-435.
2. History of Science and Technology: Textbook for Foreign Students. / I.A. Dychka, S.O. Kostyleva, S.Yu. Boeva, et al. – Kyiv: NTUU "KPI", 2015. – pp. 3-10, 11-14, 35-38, 61-73, 101-115, 139-152, 180-194, 222-239, 269-285.

3. History of Engineering. Lecture Course for Students of All Specialties of Full-Time and Part-Time Education – V.V. Morozov, V.I. Nikolaenko – Kharkiv: NTU "KhPI", 2007. – pp. 34-53, 72-90, 90-94, 117-118, 120, 259-305, 308-331. – In Russian (Electronic access: http://web.kpi.kharkov.ua/history/wp-ontent/uploads/sites/68/2013/03/ing.pdf).
4. Mykhailichenko, O. V. History of Science and Technology: Textbook. / Mykhailichenko, O. V. – Sumy: Sumy State Pedagogical University, 2013. – P. 6–13, 13–46, 46–68, 68–91, 154–163, 164–190. (Electronic access http://shron.chtyvo.org.ua/Mykhailychenko_Oleh/Istoriia_nauky_i_tekhniky.pdf).
5. History of Science and Technology: A Textbook for Students /I.K. Lebedev, L.R. Ignatova, A.I. Makhinko; KPI named after Igor Sikorsky. – Kyiv: KPI named after Igor Sikorsky. Published by "Polytechnika," 2021. – 128 p.

4.2. Additional literature.

6. Zakhariv, M. P. Review and generalization of the basic concepts of the information society / M. R. Zakhariv // Gileya: Scientific Bulletin. – Issue 48. – 2011. – P. 305–308. (Electronic access: http://archive.nbuv.gov.ua/portal/Soc_Gum/Gileya/2011_48/Gileya48/F7_doc.pdf).
7. Zerkalov D.V. NTUU "KPI". Past and Present [Electronic resource]: monograph / D.V. Zerkalov. – Kyiv: Osnova, 2012. (Electronic access mode: http://www.zerkalov.kiev.ua/sites/default/files/ntuu_kpi._minule_i_sogodennya._monografiya.pdf).
8. The history of the formation and defining trends in the development of education, science, and technology as the fundamental foundations of the Ukrainian people's life// History of Ukraine. (Socio-political aspects). Textbook. / Ed. by B. P. Kovalsky. – Part IV. – Kyiv, 2007. – pp. 53–55, 55–58, 60–72, 89–98.
9. History of Science and Technology in Ukraine / [Deshchynskyi et al.]; edited by L. E. Deshchynskyi. – Lviv: Raster-7, 2011. – pp. 10–22, 23–45, 47–72, 123–128, 130, 144–147.
10. Mudruk O. S. Features of research in the field of history of science and technology / O. S. Mudruk // Research in the history of technology. – Issue 7. – 2005. – P. 3–7, 11-14, 20-21.
11. Sova V. V. The state and trends of development of the information society in Ukraine / V. V. Sova // Formation of market relations in Ukraine. – Kyiv, 2011. – No. 5 (120). – P. 36–45.

4.3. Information resources.

1. http://www.nas.gov.ua – G. M. Dobrov Center for Research on Scientific and Technical Potential and History of Science.
2. http://www.nbuv.gov.ua/portal/natural/nnz/index.html – Website of the V. I. Vernadsky National Library of Ukraine, archive of the international scientific journal "Science and Science Studies."
3. http://pamjatky.org.ua/?page_id=685 – Archive of issues of the journal "Questions of the History of Science and Technology."
4. http://www.epochtimes.com.ua/science/ – The Great Era. Science.
5. http://www.history.com.ua/index.shtml – Ukrainian historical portal.
6. http://s-osvita.com.ua – Modern education in Ukraine and abroad.
7. http://ukrainiancomputing.org/PHOTOS/Memorial_u.html – History of the development of information technologies in Ukraine. European Virtual Computer Museum.

Educational content

4. Methodology for mastering academic discipline (educational component)

To study academic discipline, nine lectures and nine seminar lessons are planned for the study of the academic discipline, during which students must complete a Module test (consisting of 3 parts) and express tests or creative assignments (tests during distance learning).

The following teaching methods are used when studying the educational material:

Teaching method code	Teaching method	Recommended for	
		Lectures	Seminars
MN 2	**Verbal method** (lecture, conversation, instruction, etc.)	+	+
MN 3	**Visual method** (method illustrations and demonstration method)	+	+
MN 4	**Discussion method**	+	+
MN 6	**Partial search, or heuristic, method** (organization of an active search for solutions to cognitive tasks)		+
MN 7	**Problem-based teaching method (**before presenting the material: a problem is posed - a task is formulated based on various sources and means. The method of solving the problem is discussed in lesson).		+

MN 8	**Research method (**independent research work using literary and information sources/tasks, etc., and analysis of the material/task).		+

Distribution of lesson room hours by course topics and a schedule for their implementation.

Names of sections and topics	Lectures		Seminars		Assessment
	Year -	Weeks of training	Year-days	Weeks of training	
Section 1. Historical aspects of the development of science and technology in the agrarian era					
Topic 1.1. Introduction. Theoretical and methodological foundations of the "History of Science and Technology"	2	1	2	2	Seminar
Topic 1.2. Accumulation of knowledge, techniques, and technologies in prehistoric times and the era of ancient civilizations	2	3	2	4	Seminar
Topic 1.3. Technology in the Middle Ages. Scientific knowledge in the 16th-18th centuries.	2	5	1.4	6	Seminar
Thematic test No. 1			0.6		TC-1
Topics for independent work on Section 1.					
The state of scientific knowledge in the ancient world					
Science, technology, and culture in the ancient world					
Progress of human thought in the Middle Ages					
Total for section 1	**6**		**6**		
Chapter 2. Scientific thought and technological capabilities of humanity in the industrial era					
Topic 2.1. Development of technology and scientific knowledge in the mid-18th – 1870s.	2	7	2	8	Seminar
Topic 2.2 New discoveries in physics, mathematics, and natural sciences at the frontier	2	9	2	10	Seminar
19th-20th centuries					
Topic 2.3. Technological development in the early 20th century and during World War I.	2	11	1.4	12	Seminar
Thematic test No. 2			0.6		TC-2
Topics for independent work on Section 2.					
Scientific knowledge of the Renaissance					
lesson science of the modern era (17th–19th centuries)					
Technical progress and scientific knowledge in the 19th century					
Total for section 2	**6**		**6**		
Section 3. Key trends in the development of science and technology in the information age					
Topic 3.1. World science and technology in the 1920s-1940s.	2	13	2	14	Seminar
Topic 3.2. Development of science and technology in the second half of the 20th century – early 21st century.	2	15	1.3	16	Seminar
Topic 3.3 History of the emergence and development of engineering education and technical sciences. Summary of the course.			1.3	18	Seminar
Module test			0.7		MCT
Topics for independent work on Section 3.					
Scientific and technological development in the 20th century.					
Science in Ukraine at different stages of development					
Main trends and prospects for the development of science in the 21st century					

Total for Section 3	**4**		**6**		
Credit	*2*				
Total hours	**18**		**18**		

The correspondence of teaching and assessment methods is reflected in the assessment rating system, which includes: creative assignments, express tests, Module test s, and final exams.

5.1. Lectures.

No.	Lecture topic and list of key questions
1	**Introduction. Theoretical and methodological foundations of the "History of Science and Technology."** *List of main topics:* 1. Subject, purpose, objectives, and structure of the course. 2. Sources and methodology of the history of science and technology. 3. Forms of interaction between natural, physical-mathematical, and technical sciences. 4. The place and significance of the history of science and technology in the life of individuals, society, and the state.
2	**The accumulation of knowledge, techniques, and technologies in prehistoric times and the era of ancient civilizations.** *List of key questions:* 1. The emergence of simple tools. The use of fire and methods of obtaining it. 2. The invention of the bow and arrow. The emergence of complex tools. The Neolithic Revolution. 3. The use of of metals in the process and separation crafts from agriculture. 4. Technical achievements of ancient civilizations and the ancient world. The emergence of separate branches of rational knowledge.
3	**Medieval technology. Scientific knowledge of the 16th-18th centuries.** *List of main questions:* 1. The development of agriculture, crafts, mining, and construction. 2. Scientific and technical achievements of Central Asia and the Far East in the Middle Ages. 3. Manufacturing, invention, and the first machines. Scientific knowledge in the 16th-18th centuries.
4	**Development of technology and scientific knowledge in the mid-18th to 1870s.** *List of key questions:* 1. Causes, beginning, and stages of the industrial revolution in the late 18th–70s of the 19th century. 2. The development of metallurgy, the emergence of mechanical engineering, and the revolution i n transport and communications. 3. The development of physical and mathematical sciences and the creation of lessonical natural science.
5	**New discoveries in physics, mathematics, and natural sciences at the turn of the 19th and 20th centuries.** *List of key issues:* 1. The development of mathematics and astronomy. 2. Fundamental discoveries in physics. 3. Chemistry, geology, mechanics, and biology at the forefront of scientific and technological progress.
6	**The development of technology in the early 20th century and during World War I.** *List of key issues:* 1. Electrical engineering as the basis for a new stage in industrial development. 2. The application of new technologies in the metallurgical, chemical, and machine-building industries. 3. New types of transport, communications, and construction methods. 4. Military equipment during World War I.

7	**World science and technology in the 1920s-1940s.** *List of key issues:* 1. Electric power engineering, metallurgy, chemical industry, and mining as the basis for technical and technological achievements in the first half of the 20th century. 2. Features of the development of mechanical engineering in the interwar period and during World War II. 3. The creation of jet aviation and rocket technology. 4. Electronics – a step into the future. The beginning of the atomic age.
8	**The development of science and technology in the second half of the 20th century and early 21st century.** *List of key issues:* 1. Electric power engineering and electrical systems. 2. Metallurgy, chemical technologies, and mechanical engineering. 3. Development of transport. Cosmonautics. 4. Electrical engineering and communications. Computer systems.
9	**Credit**

5.2. Seminar lessons.

The main objectives of the seminar cycle are:
Seminar lessons are intended to promote in-depth understanding and consolidation of problematic theoretical issues in the academic discipline; to develop students' ability to work with historical, socio-political, scientific, and educational literature; to promote the development of linguistic culture, logical thinking, and general peRASnal culture, taking into account the student's chosen specialty, as well as the skills to prepare presentations, formulate and defend their position, actively participate in discussions, make scientifically sound assessments of past and present levels of historical and cultural development; generalize, critically reflect on, and adequately evaluate the accumulated foreign and domestic historical and cultural experience.

No.	Name of the topic
1	**The history of science and technology as a scientific and academic discipline.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. History of science and technology as a science and academic discipline. Sources and historiography. 2. Methodology of the history of science and technology and methods of learning the discipline. 3. Models of periodization of the history of science and technology. 4. Features of the development of historical-scientific and historical-technical research in Ukraine. **Assignments for independent study.** 1. The history of science and technology is a comprehensive interdisciplinary and interactive discipline. 2. Science and technology in the context of Ukraine's material and spiritual culture.
2	**The development of technology in ancient civilizations and the accumulation of scientific knowledge.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. The discovery of fire by humans and the invention of various means of obtaining it. 2. The invention and use of bows and arrows. 3 The emergence of agriculture based on complex tools. 4. The beginning of the use of metals in the production process. **Assignments for independent study.** 1. The emergence and development of mining in ancient times. 2. Features of construction in Eastern countries (Egypt, China, India, Japan). 3. Military technology in ancient times. 4. Mathematical and natural science knowledge of ancient civilizations.

3	**Features of the development of production and technology in the Middle Ages.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. Medieval guilds and their influence on the development of production. 2. Scientific and technical achievements of the countries of the Near and Far East in the Middle Ages. 3. Features of the emergence of manufactory production. 4. The development of natural science in the Late Middle Ages. **Assignments for independent study.** 1. Domestic production in the 14th–16th centuries. 2. The beginning of book printing. 3. The water wheel – the engine of manufacturing. 4. Outstanding scientists of the Middle Ages: Leonardo da Vinci, Nicolaus Copernicus, Giordano Bruno, Galileo Galilei, Johannes Kepler, Gottfried Leibniz, and Charles Fourier.
4	**The development of science and technology during the Industrial Revolution.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. The Industrial Revolution in England. The invention of the steam engine. 2. The emergence of mechanical engineering. 3. Technological revolution in transport. 4. The creation of lessonical natural science. **Assignments for independent study.** 1. Development of the metallurgical industry. 2. The technological revolution in communications. 3. M. Faraday: life and work
5	**Discoveries in physics, mathematics, and natural sciences in the last quarter of the 19th century.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. Fundamental discoveries in physics. 2. The development of mathematics. 3. Chemistry at the forefront of scientific and technological progress. 4. The emergence of new branches of mechanics.
	Assignments for independent study. 1. New directions in the development of astronomy at the end of the 19th century. 2. The invention of the internal combustion engine and its significance. 3. O. Lilienthal: life and work.
6	**Technological developments at the beginning** of **the 20th century**. *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. Electric power engineering is the foundation for industrial development. 2. The application of new technologies in mechanical engineering. 3. Features of the creation of the oil industry. 4. The development of aviation in the first decades of the 20th century. **Assignments for independent study.** 1. Technologies of metallurgical production in the early 20th century. 2. The beginning of the creation and use of artificial materials. 3. Academician O. Krylov and his contribution to the development of shipbuilding. 4. New technology on the battlefields of World War I.

7	**Science and technology in the interwar period (1920s–1940s)** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. The development of mining in the 1920s–1940s. 2. Mechanical engineering in the interwar period. 3. The creation of jet aviation. 4. Nuclear physics in the 1920s–1940s. **Assignments for independent study.** 1. The impact of the development of the electric power industry on the production of electrical equipment. 2. The development of non-ferrous metallurgy in the 1920s-1940s. 3. The creation and use of solid and liquid fuel rockets. 4. The dawn of the television era.
8	**The development of science and technology in the second half of the 20th century.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions* 1. The development of the electric power industry. 2. Stages of development of computer technology. 3. Space exploration. Space astronomy. 4. New directions in transport development **Assignments for independent study** 1. Academician S. Lebedev and his contribution to modern science. 2. S. Korolev: life and work. 3. "He was the first to set foot on the moon": N. Armstrong.
9	**The development of science and technology at the beginning of the 21st century.** *Students are expected to prepare a report/presentation and express their own opinion with justification on the following questions:* 1. New directions in the development of the electric power industry. 2. Development of computer technology and digital technologies. 3. Modern space programs. 4. New directions in the development of environmentally friendly transport **Assignments for independent study.** 1. Hubble reveals the depths of the universe. 2. The creation of computer technology in Ukraine. 3. Professional and sociocultural portrait of a modern Ukrainian engineer.

Distance learning platform:

To facilitate the assimilation of course material during the remote learning period, email, the Sikorsky distance learning platform, and the Google Meet online meeting platform are utilized.using the Moodle platform and the Google Meet and ZOOM platforms for online meetings ZOOM, which are used to:

- simplify the placement of methodological recommendations, teaching materials, literature, etc.;
- feedback is provided to students on learning tasks and the content of the academic discipline;
- completed assignments are checked and evaluated;
- keeping track of students' progress in the course, adherence to the schedule for submitting educational/individual assignments, and their assessment

5. Independent work by students.

Independent work includes: preparation for lectures and seminars; participation in discussions on relevant topics; self-assessment of acquired knowledge; study of recommended sources and literature; creation of presentations (as required) for visual accompaniment of reports; preparation for modular control work (three parts are provided); preparation for tests, etc.

6.1. Topics for independent study (up to 1 hour is allocated for each topic):

No.	Title of the topic for independent study
1.	**The state of scientific knowledge in the ancient world** ***Literature:*** [1. – pp. 38–88]; [2. – pp. 11–14]; [4 – pp. 13–24]; [6. – pp. 41–60]; [10. – pp. 34–53].
2	**Science, technology, and culture in the ancient world** ***Literature*****:** [1. – pp. 123–132; 136–142]; [2. – pp. 12–14]; [4 – pp. 25–46]; [6. – pp. 93–104]; [10. – pp. 117–120].
3	**The progress of human thought in the Middle Ages** ***References*****:** [1. – pp. 89–115; 132–134]; [2. – pp. 35–38]; [3. – pp. 53–55]; [4. – pp. 46–66]; [5. – pp. 28–39]; [6. – pp. 105–130].
4	**Scientific knowledge of the Renaissance** ***References*****:** [1. – pp. 149–164; 238–242]; [2. – pp. 35–38]; [3. – pp. 53–55]; [4. – pp. 77–86]; [5. – pp. 31–39]; [6. – pp. 135–160].
5	**lessonical science of the modern era (17th–19th centuries)** ***Literature*****:** [2. – pp. 61–70]; [4. – pp. 87–102]; [6. – pp. 164–182]; [10. – pp. 76–80]; [12. – pp. 47–53].
6	**Technical progress and scientific knowledge in the 19th century.** ***References*****:** [2. – pp. 101–115]; [3. – pp. 55–58]; [5. – pp. 105–119]; [6. – pp. 283–353; 361–370]; [10. – pp. 88–93].
7	**Scientific and technical development in the 20th century.** ***References*****:** [1. – pp. 266–290]; [2. – pp. 139–152]; [3. – pp. 58–62]; [6. – pp. 354–360].
8	**Science in Ukraine at different stages of development** ***References*****:** [1. – pp. 266–290; 294–333]; [2. – pp. 180–194]; p [3. – pp. 60–72]; [5. – pp. 120–127; 131–165; 204–211]; [10. – pp. 90–94].

6.2. *Preparation for lectures and seminars.* To prepare for lectures and seminars, students must study the planned basic and supplementary literature and recommended sources, and prepare material for discussion in lesson. Students are allocated approximately 1 hour for each topic of the discipline.

6.3. *Modular control work*. Up to 2 hours are allocated for preparation for the Module test. A list of questions for preparation for the Module test is provided in **Appendix B**.

6.4. *Credit.* The credit is held during the semester control period (credit week), at the end of the academic semester after students have written a modular control work (consisting of three parts) based on the results of the rating points earned during the semester or the teacher's decision, writes a test paper. Six hours of lesson time are allocated for preparation for the test. A list of questions for preparation for the test is provided in **Appendix A**. During the period of distance learning, the test can be conducted according to the lesson schedule using Moodle and the Google Meet and ZOOM platforms for online meetings.

Policy and control

6. Academic discipline policy (educational component)

Students are advised to follow the rules for attending lessons and behaving in them.

7.1. **Rules for attending lessons:**

Lectures. Today, the rapid growth of new scientific knowledge, the formation of new scientific concepts, and the relentless development of technology significantly outpace the process of creating modern educational publications. Therefore, it is very important for students to attend lectures that cover modern, systematic educational material and demonstrate scientific presentations in sufficient detail for students to master academic discipline. It will be difficult for students to properly prepare for seminars, complete quick tests, or prepare reports or abstracts for student scientific conferences if they do not attend lectures.

Seminar lessons. Students are encouraged to attend seminars because the final grade depends largely on the results of their work in seminar lessons. Active participation in seminars is mandatory: a student's rating will largely be based on their performance in seminars. Absence from seminars or lack of preparation for them will result in a lower final rating for academic discipline.

7.2. **Rules for completing assignments:**

When studying the material of the academic discipline "Ukraine in the Context of European Historical Development," students:

1) during lectures:

- take periodic quick tests of residual knowledge of the sections of the academic discipline, which may include either three creative assignments on discussion questions or quick test assignments (lasting 5–10 minutes using tests on the Sikorsky platform);
- complete modular control work using the Sikorsky platform;
- participate in discussions.

2) in seminars:

- prepare reports according to their own plan based on the study of sources and literature with mandatory references to them. It is desirable to accompany the reports with self-prepared presentations.
- participate in discussions on problematic issues of the course, make their own analysis and generalization of scientific information;
- justify their own positions and their position.

Tasks and materials for quick tests/creative assignments are developed by the instructor based on the course material and are submitted in Google lesson room or in another form.

7.3. **Rules of conduct in lessons.**

When studying the material of the academic discipline "History of Science and Technology," students listen attentively to the lecturer during lectures and, if necessary, write down important information, periodically complete express tests in written form (within 5–10 minutes) and Module test s (MTR) using the Sikorsky platform. The teacher will talk about the patterns of formation and development of world science and technology, the history of human activity in the scientific and technical sphere from ancient times to the present day in close connection with global historical and cultural processes. Dialogue between students and the lecturer in the form of questions and answers is permitted.

During seminars, students give oral reports and presentations, express their opinions on the topic, and participate in discussions. When searching for information on the Internet, it is recommended to use reliable and verified sources. Student work involves participation in interactive forms of lesson room organization (answering questions posed by the teacher or students). Each student is expected to be prepared on all issues of the seminar plan, supplement the reports of other students, and express their own opinion during thematic discussions. Students are allowed to use their own written notes and summaries. The use of laptops, tablets, and phones for educational purposes is permitted. At the same time, students should try to express their own opinions rather than read other people's texts. The teacher critically analyzes the presentations, comments on mistakes, and moderates' discussions between students.

The topics of lectures and seminars are covered in the course syllabus, which is available on the Electronic Campus, the History Department website, and the Sikorsky platform (Moodle, Google lesson room).

7.4. **Bonus and penalty points**

Bonus points

Students are encouraged to engage in research work and publish its results, in particular to participate in the International Scientific and Practical Conference "History, Culture, Memory in the Scientific Dimension: Status, Prospects," which is organized annually by the Department of History of Igor Sikorsky KPI. Abstracts presented at the conference on the subject of the academic discipline are awarded a maximum of +10 points. Students, together with the teacher, decide on the topic of the abstracts, available sources, and literature. Also, under the guidance of the teacher, students familiarize themselves with the requirements for formatting and submit abstracts to the conference.

Students are encouraged to participate in the annual Olympiad on "History of Ukraine" (provided they get more than 80% of the answers correct + 8 points).

Completion of a creative assignment (e.g., writing an essay based on a film recommended by the instructor) (maximum +8 points).

Other assignments and research projects.

7.5. **Deadline and resit policy.**

Missed lecture material is covered through intensive preparation for seminars. Missed seminars can be made up during consultations by answering questions from the missed seminars. To retake missed Module test s and/or quick tests, students must contact the instructor, who will organize the retake.

7.6. **University policy Academic**

integrity.

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information: https://kpi.ua/code

Standards of ethical behavior.

The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information: https://kpi.ua/code

Types of control and rating system for assessing learning outcomes (RAS)

Ongoing assessment: carried out during lessons and aimed at checking the level of student preparation for lessons. During seminars, students are surveyed on topics related to the subject. Module test s are conducted three times per semester to assess residual knowledge of three sections of the academic discipline. Express tests in written form are conducted during lectures three times per semester.

Calendar control: conducted twice per semester to monitor the current status of syllabus requirements. There are two possible results of calendar control: certified (c) and not certified (n/c). The result depends on the number of points scored at the time of calendar control in accordance with the requirements of Igor Sikorsky KPI.

Semester control: credit

Assessment and control measures

The student's grade for the course consists of points awarded for:

1) assessment of residual knowledge from 2 sections of the discipline and includes the completion of three creative tasks on discussion questions or express test tasks (within 5-10 minutes using tests on the Sikorsky platform);

2) work in 8 seminars;

3) Module test work Student work:

- in eight seminars determines 45% of their rating in the discipline;
- The assessment of residual knowledge from the sections accounts for 18% of his grade for the course.
- Module test work determines 37% of his rating in the discipline.

In order to receive the highest rating, students must actively participate in seminars, deliver well-prepared and reasoned oral reports on seminar topics, actively supplement the answers of other students, clearly and logically express their own position on discussion topics, and complete Module tests and express tests in a timely manner. Students are given a one-time opportunity to complete coursework and express tests.

The following factors lead to a decrease in a student's rating: failure to complete Module test and express controls; inadequate preparation for seminars; inaccuracies, incompleteness, errors in answers, or reliance on unreliable historical sources.

The instructor evaluates the students' work at each seminar and assigns grades for seminar work and the results of the Module test and express controls to the module
"Current Control" module of the Electronic Campus. The results of the first and second calendar controls depend on the student's current rating and are entered by the instructor into the
"Calendar Control" module of the Electronic Campus in the eighth and sixteenth weeks of study, respectively (see **Appendix C**).

The student may appeal the teacher's grade by submitting a complaint to the teacher no later than the day after the student has been informed of the grade given by the teacher. The complaint will be considered in accordance with the procedures established by the university.

Conditions for admission to semester control: A minimum of 40 points and a minimum grade of "sufficient" for the Module test.

Table of correspondence between rating points and grades on the university scale:

Number of points	*Grade*
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

7. Additional information on the discipline (educational component).

A recommended list of questions for semester assessment (test) is provided in **Appendix A** to the syllabus.

If a student has documents confirming their participation in competitions and scientific conferences (city, inter-city, All-Ukrainian, etc.) on the topic of a seminar or section of an academic discipline, they may be credited with the corresponding subject and corresponding RAS points.

Recommendations for students

While attending lectures, students should write down key terms and concepts, note the main events of the proposed topic, and summarize the generalizations and conclusions made by the lecturer. This material will be useful when preparing for seminars, Module tests, and quick tests.

When preparing for a seminar, students must study the lecture material on a specific topic and, preferably, familiarize themselves with additional resources on the Internet. If questions arise or unclear points are identified, they should be discussed with the teacher. Even well-prepared students should not remain passive observers during seminars; it is advisable to actively participate in discussions. Students should not refuse to answer the instructor's questions. Even if a student does not know the answer, it is advisable to try to answer, express their opinion based on their own knowledge, experience, the logic of the question, etc. At the same time, there is no need to be afraid of making mistakes – one of the important tasks of studying the humanities is to develop the ability to think logically and express one's thoughts accordingly. However, it is worth remembering that ignorance of the subject matter is a significant shortcoming in a student's work and will negatively affect their overall rating. A responsible attitude towards preparation for each seminar allows you not only to correctly master the educational material, but also to save effort when passing the semester exam.

An important aspect of student preparation is developing the ability to work with historical sources. When encountering a historical document that is new to them, students should first determine its authenticity, the conditions and reasons for its creation, understand the logic and sequence of relevant events and their impact on the present. Such analysis will allow the student not only to better understand and assimilate information, but also to analyze past historical events, draw conclusions and generalizations, and apply historical experience to understand and determine the role and place of a particular scientist and inventor in the history of the development of science and technology.

Acquiring scientific historical knowledge is an interesting but difficult task. By studying the academic discipline "History of Science and Technology," you are laying the foundation for your future professional growth and development. This course will help you correctly understand the phenomenon of science and technology in human history and the main features of the process of accumulating scientific and technical knowledge in accordance with specific historical stages of human development.

Students may be credited for the course if they have certificates of completion of distance or online courses on the relevant subject or have won prizes in history competitions on the subject.

Extracurricular activities.

Students may participate in:

- scientific research work and the publication of its results, in particular participation in international scientific and practical conferences, primarily the one held annually by the Department of History ("Ukraine: History, Culture, Memory");
- activities of the student scientific club "History Fans Club";
- competitions in historical disciplines.

Distance learning

Synchronous and asynchronous distance learning is possible using video conferencing platforms (Google Meet, Zoom, etc.) and the distance learning educational platform
"Sikorsky" (Moodle).

Inclusive learning
Permitted.

The working program of the academic discipline (syllabus) was compiled by:
Associate Professor of the Department of History, Associate Professor, Candidate of Historical Sciences Lyudmila IGNATOVA

Approved by the Department of History (Minutes No. 7 of January 24, 2024)

Approved by the Methodological Council of the RTF (Minutes No. 06/2024 of June 28, 2024).

Appendix A

List of questions for semester control (test) Sample test ticket

NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE "

Level of higher education **(bachelor's)**
(degree name)

Specialty ***172 Electronic Communications and Radio Engineering***
(code and name of the training program)

Educational program ***Intellectual technologies of radio-electronic engineering***
(code and name of specialty)

Academic discipline ***History of Science and Technology***
(name)

TEST SHEET No.

1 *Questions from Block I*
2 *Questions from Block II*

Approved at a meeting of the History Department
(name of department)

Minutes No. of " " 202

Head of the Department of History
(signature) (First name, last name)

QUESTIONS for the preparation of exam tickets *

Question I from the set of questions

1. Define the place of the history of science and technology in the system of humanities, natural sciences, and technical sciences.
2. Provide a definition and reasoned assessment of the problem of humanizing scientific and technical knowledge.
3. Compare the main versions of the periodization of the history of science and technology.
4. Describe the source base of the history of science and technology, taking into account the characteristics of different types of sources.
5. Analyze the level of development of human knowledge and technology in the Paleolithic and Mesolithic periods.
6. Describe the Neolithic Revolution in its main centers, linking the level of development of knowledge and technology with natural conditions.
7. Make a comparative analysis of the scientific and technical achievements of the ancient civilizations of Egypt and Mesopotamia.
8. Identify the main achievements of science and technology in ancient India and China.
9. Describe and explain the peculiarities of the development of technology in ancient Greece.
10. Provide a reasoned assessment of the transition from a mythological to a scientific perception of the world in ancient Greece, using the example of its impact on natural and technical knowledge.
11. Using the comparative-historical method, identify new features in the development of scientific and technical knowledge during the Hellenistic period.
12. Identify the key features of the development of science and technology during the Roman Empire. Justify your answer.
13. Compare approaches to the development of scientific knowledge in the Christian and Muslim worlds during the Middle Ages.
14. Describe the views of leading researchers on the role of the Middle Ages in the development of technology and identify the most plausible one. Justify your answer.
15. Explain how the spread of humanism and the Reformation influenced the development of science in Europe during the Renaissance.
16. Define the essence of the Great Geographical Discoveries and their consequences for scientific and technological development.
17. Provide a reasoned opinion on whether it is appropriate to use the terms "gunpowder revolution" and

"agrotechnical revolution" in relation to Europe during the Renaissance.

18. Identify the preconditions and explain the essence of the scientific revolution of the 17th century.

19. Explain how the spread of the ideology of the Enlightenment and scientific and technological progress are related.

20. Describe the main consequences of the scientific revolution of the 17th century and the essence of the mechanistic worldview.

Question II from the set of questions

1. Indicate what caused the industrial revolution of the 18th–19th centuries and led to its uneven spread throughout the world.

2. Provide a comparative description of machine and manufactory production.

3. Describe and evaluate the contribution of leading scientists to the development of lessonical natural science in the 18th and mid-19th centuries.

4. Identify the main stages and directions of the Industrial Revolution.

5. Define the essence and consequences of fundamental scientific discoveries of the late 19th and early 20th centuries.

6. Explain the difference between non- lessonical and lessonical science.

7. Provide a reasoned explanation of the impact of World War I on the development of science and technology.

8. Describe the leading scientific discoveries in the period between the First and Second World Wars.

9. Compare the pace of improvement in peaceful and military production during the interwar period.

10. Provide a reasoned assessment of the overall state of science and technology during World War II, depending on the extent of countries' participation in hostilities.

11. Describe the structure, periodization, and main consequences of the scientific and technological revolution.

12. Identify the positive and negative impacts of scientific and technological progress on the ecosystem.

13. Provide a reasoned assessment of the effectiveness of major international environmental protection programs.

14. Compare the leading concepts for defining information society and its components.

15. Trace the main stages of development of the latest information technologies.

16. Describe the Internet as an environment for building an information society.

17. Identify the main features of scientific and technological development in Ukraine under market conditions.

18. Compare the achievements of academic and industry research institutions and the achievements of higher education researchers in independent Ukraine.

19. Describe Ukraine's international cooperation in the field of science and technology, as well as possible ways to expand and deepen such cooperation.

20. Provide a reasoned assessment of the international cooperation of the Igor Sikorsky Kyiv Polytechnic Institute in the scientific and technical sphere and outline its possible prospects.

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Appendix B

MODULE TEST

in academic discipline

HISTORY OF SCIENCE AND TECHNOLOGY

first (bachelor's) level of higher education***, bachelor's degree****

form of study ***full-time***

After completing each of the three thematic modules, students are given a one-time opportunity to write an Module test, which consists of test tasks. The first and second Module test s are each worth 12 points. The third Module test is worth 13 points. The maximum number of points for three Module test s is 37 points.

TASKS for Module test 1.1. from Section 1. **Historical aspects of the development of science and technology in the agrarian era**

Test questions are formed from the following blocks

1. Theoretical and methodological foundations of the "History of Science and Technology";
2. Accumulation of knowledge, techniques, and technologies in prehistoric times and the era of ancient civilizations. The state of scientific knowledge in the ancient world. Science, technology, and culture in the ancient world;
3. Medieval technology. Progress of human thought in the Middle Ages. Scientific knowledge of the Renaissance and Modern Era (15th-18th centuries).

TASKS for Module test **1.2.** from Section 2. **Scientific thought and technological capabilities of humanity in the era industrial**

The test tasks are formed from the following blocks

1. The development of technology and scientific knowledge in the mid-18th to 1870s. lessonical science of the modern era (17th-19th centuries);
2. Technical progress in the 19th century. New discoveries in physics, mathematics, and natural sciences at the turn of the 19th-20th centuries.
3. The development of technology in the early 20th century and during World War I.

TASKS for MODULE TEST 1.3. from Section 3. **Key trends in the development of science and technology in the information age**

Test tasks are formed from the following blocks

1. World science and technology in the interwar period (*1920s-1940s*);
2. The development of science and technology in the second half of the 20th century;
3. Main trends and prospects for the development of science in the 21st century;
4. Science in Ukraine at different stages of development;
5. The history of the emergence and development of engineering education and technical sciences.

Appendix C

RATING SYSTEM FOR ASSESSING LEARNING OUTCOMES
in the academic discipline
HISTORY OF SCIENCE AND TECHNOLOGY
first (bachelor's) level of higher education***, bachelor's degree****

form of study ***full-time***

1. A student's grade for an academic discipline consists of points awarded for [1] :
- assessment of residual knowledge in 9 lectures;
- work in 8 seminars;
- a Module test (MT) consisting of three parts, each worth 0.66 academic hours.

Rating (weighted) point system and assessment criteria:

1. Residual knowledge can be tested either in 9 lectures (in which case the maximum number of points for 1 test in a lecture is 2 points):

– complete answer (at least 90% of the required information), relevant reasoning and peRASnal opinion provided	2
– a sufficiently complete answer (at least 75% of the required information), which meets the requirements for the "skills" level, or minor inaccuracies)	1.5
– incomplete answer (at least 60% of the required information)	1

Or

Residual knowledge can be tested in 3 lectures (in which case the maximum number of points for 1 test per lecture is 6 points):

– complete answer (at least 90% of the required information), relevant reasoning and peRASnal opinion provided	6
– a sufficiently complete answer (at least 75% of the required information), which meets the requirements for the "skills" level, or minor inaccuracies)	5-4
– incomplete answer (at least 60% of the required information)	3.5

2. Work during 8 seminars (the maximum number of points for the first seminar is 5 points; additional points are awarded for active participation in the seminar, but no more than 5)

– complete answer (at least 90% of the required information), relevant justifications and peRASnal opinion provided	5
– sufficiently complete answer (at least 75% of the required information), performed in accordance with the requirements for the "skills" level, or minor inaccuracies)	4
– incomplete answer (at least 60% of the required information)	3

3. Writing Module test consisting of 3 parts from 37 tests *(the maximum number of points for 1 test is 1 point*
s). Correct answer – 1 point Incorrect answer
– 0 points

Calculation of the rating scale (R):

The sum of the weighted points for control measures during the semester is:

RD = 18+45+37 = 100 points.

[1] NPPs may make adjustments to the RAS in accordance with the form of study chosen by students and their own methodological developments

Students who have earned 60 or more points during the semester (***RD ≥ 0.6 R)*** receive a credit automatically according to their rating.

Students who have not completed the Module test (less than "sufficient") and have received less than 40 starting points are not allowed to take the credit.

Students who have fulfilled the conditions for admission to the exam but have scored less than 60 points during the semester (***RD < 0.6 R)*** take a final exam.

The test is graded on a scale of 100 points and consists of two questions. *(The maximum number of points for 1 question is 50 points)*

– a complete answer (at least 90% of the required information)	50-45
– sufficiently complete answer (at least 75% of the required information)	44
– incomplete answer (at least 60% of the required information)	37

Based on the results, the student receives a corresponding grade according to the table.

Number of points	**Grade**
100	Excellent
94	Very good
84–75	Good
74–65	Satisfactory
64–60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted