Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

КАФЕДРА ІСТОРІЇ

Department of History, FSP

SCIENTIFIC AND TECHNOLOGICAL REVOLUTIONS AND THE MODERNIZATION OF EUROPE

Work programme for the academic discipline (Syllabus)

Course details

Level of higher education	***Second (Master's)***
Field of knowledge	**Social sciences, journalism, information and international relations**
Specialisation	C5 Sociology
Educational programme	*Social Data Analytics*
Status of discipline	*Elective*
Form of study	*Full-time (day)*
Year of training, semester	*1 year of training, spring semester.*
Scope of the discipline	*4 credits, ECTS / 120 hours (lectures – 16 hours, seminars – 30 hours, independent work – 74 hours).*
Semester control/control measures	*Test, Modular control work*
Class schedule	*The class schedule is available at https://schedule.kpi.ua/*
Language of instruction	*Ukrainian*
Information about course director / lecturers	*Lecturer:* **Serhii V. Choli**, *PhD, Associate Professor* scholij@ukr.net *Seminar instructors: Associate Professor* **Serhii V. Choli**, scholij@ukr.net
Course location	*Courses are hosted on the Sikorsky distance learning platform using Moodle* *https://do.ipo.kpi.ua/course/view.php?id=2077*

Curriculum

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

"***SCIENTIFIC AND TECHNICAL REVOLUTIONS AND MODERNISATION OF EUROPE***" is a course that belongs to the elective educational components of the master's degree programme in "SOCIAL DATA ANALYTICS".

The aim of the course is to develop a scientific worldview in future specialists; to promote the growth of general erudition; providing knowledge about the main stages, processes and events and the formation of Europe as a geopolitical reality; familiarising students with the history of the accumulation of scientific knowledge in specific fields of natural, social and human sciences and technical sciences in accordance with specific historical stages of human development.

The subject of study is the genesis, patterns of formation and development of world science and technology, and the history of the impact of this development on European modernisation processes.

The academic discipline, in conjunction with other educational components, provides an opportunity to deepen professional training within the chosen speciality and educational programme, develop specific competencies and learning outcomes, in particular:

General competencies (soft skills):

- Ability to think abstractly, analyse and synthesise in order to make informed decisions.
- Ability to identify, set and solve problems, evaluate and ensure the quality of work performed.
- Ability to search for, process and analyse information from various sources, conduct research at the appropriate level.

Professional competencies:

- Ability to plan and carry out scientific research in the field of history and archaeology Ability to use historical and philosophical heritage in understanding and solving research problems.
- Ability to select and apply the most effective methodological research strategy.
- Awareness of the principles of academic integrity and professional ethics.

Programme learning outcomes:

- Analyse theoretical and methodological problems of contemporary historical and philosophical science, critically evaluate the state of the problem and the results of recent research, apply relevant methods of their analysis and interpretation.
- Propose and justify new approaches to solving tasks and problems.
- Clearly and unambiguously convey one's knowledge, conclusions and arguments on issues of history and/or archaeology to specialists and non-specialists, in particular to students.

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

The discipline is integrated into the structural-logical scheme of training in the form of an elective course for the formation of general competencies of a specialist/applicant (soft skills).

Prerequisites The discipline is taught in the second semester of the first year of study and is interdisciplinary in nature and is studied on the basis of other disciplines of the first (bachelor's) and second (master's) levels of higher education in the social sciences and humanities.

Post-requisites the academic discipline ensures the formation of a scientific worldview for masters with ONP "SOCIAL DATA ANALYTICS" of the second (master's) level of higher education and is a supplement for acquiring research skills and an additional basis for preparing sections of a dissertation.

3. Content of the academic discipline

Chapter 1. Historical aspects of European development in the agrarian era
Topic 1.1. Introduction. Theoretical and methodological foundations of the course
Topic 1.2. Accumulation of knowledge, techniques and technologies in prehistoric times and the era of ancient civilisations
Topic 1.3. Technology in the Middle Ages. The Scientific Revolution of the 17th century.
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 and 20th centuries.
Topic 2.3. The end of the Modern era in Europe. The results of European modernisation by the beginning of the 20th century.

Section 3. Key trends in the information age

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

Topic 3.2. The scientific and technological revolution and the emergence of the information society in Europe.

4. Teaching materials and resources

For successful study of the discipline and preparation for lectures, seminars, Modular control work and independent work, the following are used: teaching materials presented in lectures, basic and additional literature, which the student studies independently using lecture notes, Internet resources and distance learning materials. In the context of distance learning, literature available in electronic form on university and external media may be used.

4.1 Basic literature

1. Ivanova Natalia. History of Mathematics in the Cultural Heritage of Europe (in three volumes). – Kyiv, 2026. https://surl.li/cjbrie (accessed on 01.01.2026).
2. History of Science and Technology [Text]: textbook for students of the Faculty of Applied Mathematics / S. Choliy, I. Perga; National Technical University of Ukraine "Igor Sokorsky Kyiv Polytechnic Institute". - Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, Publ. House "Politechnica", 2023. https://ela.kpi.ua/items/88d4394e-cfde-48d8-9942-ecaf84e3725e (accessed 01.01.2026).
3. Origins and Development of Electrical Engineering Education and Science at Lviv Polytechnic (1891–2016): On the 125th Anniversary of the Lviv School of Electrical Engineering / ed. by P. G. Stakhiv. — Lviv: Lviv Polytechnic Publishing House, 2017 https://catalog.lounb.org.ua/bib/408022 (accessed on 01.01.2026).
4. The Renaissance. History. Philosophy. Science and Technology / edited by Umberto Eco; translated from Italian by O. K. Kolodyazhna [and 4 others]. - Kharkiv: Folio, 2020. - 522 p. https://surl.li/ronlfs (accessed on 01.01.2026).

4.2. Additional literature

1. From the history of Ukrainian science and technology. Anthology-manual / Co-authors-compilers V. I. Onoprienko, A. A. Korobchenko, O. Ya. Pylypchuk, S. P. Ruda, L. P. Yaresko. – Kyiv: Academy of Sciences of Higher Education of Ukraine, 1999. – P. 3–7.
6. Zakhariv M. P. Review and generalisation 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)(date of access – 01.06.2025)
7. Zerkalov D.V. NTUU "KPI". Past and Present [Electronic resource]: monograph / D.V. Zerkalov. – Kyiv: Osnova, 2012. (Electronic access: http://www.zerkalov.kiev.ua/sites/default/files/ntuu_kpi._minule_i_sogodennya._monografiya.pdf) (date of access – 01.06.2025)
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. Ye. 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.
12. Choliy, S. History of Science and Technology. Textbook for students of the Faculty of Applied Mathematics [Electronic resource] : textbook for bachelor's degree holders by specialty 113 "Applied Mathematics", 121 "Computer Engineering", 123 "Software Engineering of Multimedia and Information Retrieval Systems" / S. Choliy, I. Perga ; Igor Sikorsky Kyiv Polytechnic Institute. –

Electronic text data (1 file: 1.92 Mb). – Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 204 p. https://ela.kpi.ua/handle/123456789/59491 (date of access – 01.06.2025).

4.3. Information resources

1. http://www.nas.gov.ua – G. M. Dobrov Centre for Research on Scientific and Technical Potential and History of Science.

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".

http://pamjatky.org.ua/?page_id=685 – Archive of issues of the journal "Questions of the History of Science and Technology".

http://www.epochtimes.com.ua/science/ – The Great Era. Science.

http://www.history.com.ua/index.shtml – Ukrainian historical portal.

http://s-osvita.com.ua – Modern education in Ukraine and abroad.

http://n-t.ru/tp/it/ – History of technology. Articles.

http://ukrainiancomputing.org/PHOTOS/Memorial_u.html – History of the development of information technologies in Ukraine. European Virtual Computer Museum.

Educational content

5. Methods of mastering the academic discipline (educational component)

During the study of the academic discipline (educational component), it is planned to conduct 8 lectures and 15 seminars, write one Modular control work (consisting of 3 parts on the topics of the sections), and conduct express tests during lectures.

During the course and for interaction with students, active and collective learning strategies are used, which are defined as follows:

1. **Learning technologies**:

- *personality-oriented (developmental) technologies* based on active forms and methods of learning (brainstorming, business games, scientific discussion, express conference, round table);
- *information and communication technologies* that ensure the problem-solving and research-oriented nature of the learning process and stimulate independent work by students (electronic presentations for lectures, use of audio and video support for classes). Development and application of creative tasks based on computer and multimedia tools, supplementing traditional classes with interactive tools based on network communication capabilities (online seminars). Distance learning uses video conferencing servers such as ZOOM and/or Goggle Meet, the Google Classroom educational web service on the Sikorsky platform, messengers for communication with students, and the university software of the Electronic Campus Information and Telecommunications System.

2. **Teaching methods**:

2.1. The following are used in **lectures**:

- *explanatory-illustrative* method, which allows students to obtain knowledge from educational or methodological literature through a screen manual (presentation) in a "ready-made" form. They perceive and comprehend facts, assessments, conclusions and remain within the framework of reproductive (reproductive) thinking. This method allows a large amount of information to be conveyed to learners.

- *the problem-based presentation method*. During the lesson, *the teacher raises* a problem, formulates a cognitive task based on various sources and means, and shows how to solve the task. For their part, students not only perceive, understand and memorise ready-made information, but also follow the logic of the arguments and the teacher's train of thought.

2.2. The following methods are used in **seminars**:

- *partial-search* (heuristic conversation) and *research* methods, which help to organise an active search for solutions to problems raised during training and the completion of cognitive tasks. During the seminar, students independently study literature and sources and perform other research tasks. These methods activate students' thinking and stimulate their interest in learning.
- - *The discussion method* stimulates critical thinking, encourages independent thinking through the clear formulation of one's own thoughts, requires information processing skills, and forces students to comprehend the learning material.

- *Business games* as a method involve active creative learning.
- *The partial search or heuristic method* ensures the organisation of an active search for solutions to cognitive tasks.
- *The problem-based method* is based on posing a problem and formulating a task using various sources and means. The class examines how to solve the problem.
- *The research method* involves independent research work with literary and information sources/tasks and analysis of the material/task.

The correspondence of teaching and assessment methods is reflected in the assessment rating system, which includes: express tests, Modular control work, and final exams.

Below is the distribution of classroom hours by course topics, the schedule for their implementation, control measures and the assessment system (the following abbreviations are used in the table: L. - lecture, S. - seminar, MCT - modular control work, SR - independent work).

Names of sections and topics	**Lecture**		**Seminar**		**Description of classes**	**SR**	**Control measures**
	Year	Week	Year	Week			
Section 1. The emergence of scientific knowledge							
Topic 1.1. Introduction.	2	1	4	1	L.1. Introduction. Theoretical and methodological foundations of the course C.1. Accumulation of knowledge, techniques and technologies in the pre-scientific period of human existence	8	Quick check on lecture No. 1. Work on seminar No. 1-2.
Topic 1.2. Accumulation of knowledge, techniques and technologies in the pre-scientific period of human existence	2	3	4	3	L.2. Accumulation of knowledge, techniques and technologies in the pre-scientific period of human existence P. 2. Accumulation of knowledge, techniques and technologies in prehistoric times and the era of ancient civilisations	8	Quick check on lecture No. 2. Seminar work No. 3-4.
Topic 1.3. Technology of the Middle Ages. The Scientific Revolution of the 17th century.	2	5	3	5	L.3. The Scientific Revolution of the 17th Century and Its Impact on Electrical Engineering S.3. Technology in the Middle Ages. The Scientific Revolution of the 17th Century.	8	Quick check on lecture No. 3. Seminar work No. 5-6.
Modular control work on section 1.			0.6			2	MCT 1.1.
Total for section 1	**6**		**12**			**26**	
Section 2. The development of humanity in the industrial era							
Topic 2.1 Development of technology and scientific knowledge in the mid-18th – 1870s	2	7	4	7	L.4. Development of technology and scientific knowledge in the mid-18th – 1870s. P.4 Development of technology and scientific knowledge in the mid-18th – 1870s.	8	Quick check on lecture No. 4. Work on seminar №7-8.
Topic 2.2. New discoveries in physics, mathematics and natural sciences at	2	9	4	9-10	L.5. New discoveries in physics, mathematics and natural sciences at the turn of the 19th and 20th centuries. P.5. New discoveries in physics,	8	Quick check on lecture No. 5. Seminar work No. 9-

Names of sections and topics	Lecture		Seminar		Description of classes	SR	Control measures
	Year	Week	Year	Week			
the turn of the 19th and 20th centuries.					mathematics and natural sciences at the turn of the 19th-20th centuries.		10.
Topic 2.3. The end of the Modern era in Europe. The results of European modernisation by the beginning of the 20th century.	2	11	3	11	L.6. The end of the Modern era in Europe. The results of European modernisation before the beginning of the 20th century.	8	Quick check on lecture No. 6. Seminar work No. 11-12.
					P.6. The end of the Modern era in Europe. The results of European modernisation before the beginning of the 20th century.		
Modular control work on section 2.			0.6				Modular control work 1.2.
Total for section 2	**6**		**12**			**24**	
Section 3. Key trends in the information age							
Topic 3.1. World science and technology in the 1920s-1940s	2	13	3	13	L.7. World science and technology in the 1920s-1940s.	8	Quick check on lecture No. 7. Seminar work No. 13-14.
					P.7. World science and technology in the 1920s-1940s.		
Modular control work on section 3.			0.7				Modular control work 1.3.
Topic 3.2. Scientific and technological progress and the emergence of the information society in Europe.	2	15	2	15	L.8. Scientific and technological progress and the emergence of the information society in Europe.	10	Quick check on lecture No. 8. Seminar work No. 15.
					S.8. Scientific and technological progress and the emergence of the information society in Europe.		
Total for section 3	**4**		**6**			**18**	
Credit					**According to schedule**	**6**	
Total	**16**		**30**			**74**	

5.1 Lectures

The lecture course on the academic discipline "***SCIENTIFIC AND TECHNICAL REVOLUTIONS AND MODERNISATION OF*** EUROPE" covers modern, systematic educational material and includes scientific presentations sufficient for students to master the discipline.

Lecture 1. Topic 1.1. Introduction. Theoretical and methodological foundations of the course

List of main issues:

1. Subject, purpose, objectives and structure of the course.
2. Sources, 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 subject in the life of the individual, society and the state.

Lecture 2. Topic 1.2. Accumulation of knowledge, techniques and technologies in prehistoric times and the era of ancient civilisations

List of main 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 metals in the production process and the separation of crafts from agriculture.
4. Technical achievements of ancient civilisations and the ancient world. The emergence of separate branches of rational knowledge.

Lecture 3. Topic 1.3. Technology of the Middle Ages. The Scientific Revolution of the 17th century.
List of main questions:
1. Development of agriculture, crafts, mining and construction techniques. 2. Scientific and technical achievements of Central Asia and the Far East in the Middle Ages.
3. Manufactories, inventions and the first machines. Scientific knowledge in the 16th-18th centuries.

Lecture 4. Topic 2.1. Development of technology and scientific knowledge in the mid-18th to 1870s.
List of main questions:
1. Causes, beginning and stages of the industrial revolution in the late 18th – 70s of the 19th century.
2. Development of metallurgy, emergence of mechanical engineering, revolution in transport and communications.
3. Development of physical and mathematical sciences and the creation of classical natural science.

Lecture 5. Topic 2.2. New discoveries in physics, mathematics and natural sciences at the turn of the 19th and 20th centuries
List of key questions:
1. Causes, beginning and stages of the industrial revolution in the late 18th – 1870s.
2. The development of metallurgy, the emergence of mechanical engineering, and the revolution in transport and communications.
3. Development of mathematics and astronomy.
4. Fundamental discoveries in physics.
5. Chemistry, geology, mechanics and biology at the forefront of scientific and technological progress

Lecture 6. Topic 2.3. The end of the Modern era in Europe. The results of European modernisation by the beginning of the 20th century.
List of key questions:
1. Electrical engineering as the basis for a new stage of industrial development.
2. Application of new technologies in the metallurgical, chemical and machine-building industries.
3. New types of transport, communications and construction methods.
4. Military technology during the First World War.

Lecture 7. Topic 3.1. 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.

Lecture 8. Topic 3.2. The scientific and technological revolution and the emergence of the information society in Europe.
List of main questions:

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.

5.2. Seminar classes

The main objectives of the seminar series are:

- to develop students' ability to work with historical, socio-political, memoir and educational literature; to prepare presentations, formulate and defend their position, and actively participate in discussions.

Topic 1.1. Introduction. Theoretical and methodological foundations of the course

Seminar 1:

List of key issues:

1. Subject, purpose, objectives and structure of the course.
2. Sources, methodology of the history of science and technology.

Seminar 2:

List of key issues:

1. Forms of interaction between natural, physical, mathematical and technical sciences.
2. The place and significance of the subject in the life of the individual, society and the state.

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

Seminar 3:

List of key issues:

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.

Seminar 4:

List of key questions:

1. The use of metals in the production process and the separation of crafts from agriculture.
2. Technical achievements of ancient civilisations and the Ancient World. The emergence of separate branches of rational knowledge.

Topic 1.3. Technology of the Middle Ages. The Scientific Revolution of the 17th century.

Seminar 5:

List of key issues:

1. Development of agriculture, crafts, mining and construction techniques.
2. Scientific and technical achievements of Central Asia and the Far East in the Middle Ages.

Seminar 6:

List of key issues:

1. Manufactories, inventions and the first machines.
2. Scientific knowledge in the 16th-18th centuries.

Conducting the first part of the Modular control work.

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

Seminar 7:

List of key questions:

1. Causes, beginning and stages of the industrial revolution in the late 18th – 70s of the 19th century.

2. Development of metallurgy, emergence of mechanical engineering, revolution in transport and communications.
3. Development of physical and mathematical sciences and the creation of classical natural science.

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

Seminar 8:

List of key questions:

1. Causes, beginning and stages of the industrial revolution in the late 18th – 70s of the 19th century.
2. Development of metallurgy, emergence of mechanical engineering, revolution in transport and communications.

Seminar 9:

List of key issues:

1. Development of mathematics and astronomy.
2. Fundamental discoveries in physics.
3. Chemistry, geology, mechanics and biology at the forefront of scientific and technological progress

Topic 2.3. The end of the Modern era in Europe. The results of European modernisation by the beginning of the 20th century.

Seminar 10:

List of key questions:

1. Electrical engineering as the basis for a new stage of industrial development.
2. Application of new technologies in metallurgy, chemical and machine-building industries.

Seminar 11:

List of key issues:

1. New types of transport, communications and construction methods.
2. Military equipment during the First World War.

Conducting the second part of the Modular control work.

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

Seminar 12:

List of key questions:

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.

Seminar 13:

List of key issues:

3. The creation of jet aviation and rocket technology.
4. Electronics – a step into the future. The beginning of the atomic age.

Topic 3.2. Scientific and technological progress and the emergence of the information society in Europe.

Seminar 14:

List of key issues:

1. Electric power engineering and electrical systems.

2. Metallurgy, chemical technologies and mechanical engineering.

3. Transport development. Cosmonautics.

4**.** Electrical engineering and communications. Computer systems.

Topic 3.3 History of the emergence and development of engineering education and technical sciences. Summary of the course.

Seminar 15:

List of key questions:

1. The emergence and development of education and scientific research.

2. The emergence of technical sciences and engineering.

3. Creation of technical educational institutions and development of technical education in Ukraine.

4. Igor Sikorsky Kyiv Polytechnic Institute: history and present day

Conducting the third part of the Modular control work

Distance learning platform*:*

For better assimilation of the material of the academic discipline during the period of distance learning, e-mail, messengers, the Sikorsky distance learning platform based on the Google Classroom system, and the Google Meet platform for online meetings are used, with the help of which:

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

5. Independent work of applicants

Independent work includes: preparation for lectures and seminars; preparation for participation in discussions on the topic; self-assessment of acquired knowledge; studying sources from the list of literature (basic/additional); creating presentations (as required) for visual accompaniment of reports; preparing for modular control work (MCW); tests, etc.

6.1. *Topics for independent study* – not planned

6.2. *Preparation for lectures and seminars.* To prepare for lectures and seminars, the applicant must study the planned basic and supplementary literature and prepare material for discussion in class.

6.3. *Modular control work*. The list of topics for preparation for the Modular control work is provided in section 5.2 of the syllabus.

6.3. *Express tests.* For express tests, the lecturer develops tasks (*one problem question from the section of the discipline, conducive to generalisation, analysis and synthesis of historical, general humanitarian and general scientific information, formulation of the applicant's own position on the material presented in order to understand the essence of historical processes*) and informs students of them in a timely manner.

6.4. Credit. Credit is awarded according to the schedule in week 16, after the applicants have written their Modular control work. Based on the results of the rating points earned during the semester, the applicant receives credit without additional tests if the total number of points earned is not less than 60. Applicants who have fulfilled all the conditions for admission to the credit and have rating points from 40 to 59, or wish to improve their results, take a credit test or undergo an interview on credit questions. Up to 6 hours of study time is allocated for preparation for the credit. A list of questions for preparation for the credit is provided in **Appendix A**. During the distance learning period, the credit can be taken according to the class schedule using Google Classroom and the Google Meet online meeting platform.

Policy and control

6. Academic discipline (educational component) policy

7.1. Rules for attending classes

Lectures. "SCIENTIFIC AND TECHNICAL REVOLUTIONS AND MODERNISATION OF EUROPE" is a discipline that is dynamically changing and constantly being replenished with new knowledge, concepts and facts. Therefore, it is necessary to attend lectures where systematic educational material is presented, presentations are shown, and attention is focused on the main issues of specific topics. Without attending lectures, it will be difficult for students to prepare for seminars, Modular control work, complete quick tests, prepare reports or abstracts for student scientific conferences. There is no need to make up for missed lectures.

Seminar classes. Students are encouraged to attend seminars, as the final grade largely depends on the results of their work in seminar classes. Active participation in seminars is mandatory: a student's rating will largely be determined by their performance in class. Absence from seminars or lack of preparation for them will result in a lower final grade for the course.

7.2. Rules for completing assignments

When studying the course material for the discipline "SCIENTIFIC AND TECHNICAL REVOLUTIONS AND MODERNISATION IN EUROPE", students:

1) **during lectures**:

- take periodic quick tests of residual knowledge of the sections of the discipline, which may include creative tasks on discussion questions or quick test tasks (within 5-10 minutes using tests on the Sikorsky platform or written work);
- conduct analytical reviews using a discussion format of communication between the lecturer and students.

2) **During seminars**

independently

- complete a Modular control work in writing or using the Sikorsky platform;

under the guidance of the teacher:

- organise discussions among students on problematic issues of the course, focusing on the analysis and generalisation of scientific information;
- justify their own positions and their position on the assessment of the material presented.

Tasks and materials for express tests/creative assignments and Modular control work are provided in the appendix to the working curriculum.

7.3. Rules of conduct in class.

When studying the material of the academic discipline "***SCIENTIFIC AND TECHNICAL REVOLUTIONS AND MODERNISATION OF*** EUROPE", students *should* listen carefully to the lecturer during **lectures** and, if necessary, take notes on important information, periodically complete express tests in written form (lasting 5–10 minutes). Dialogue between students and lecturers is recommended/permitted.

During seminars, students:

- complete modular control work (MCW) using the Sikorsky platform;
- give oral reports, demonstrate presentations, express their own opinions on the topic, and participate in discussions. The participation of students in seminars is assessed as a cumulative task, which includes:
    - a presentation on the main topic;
    - additions, questions to the speaker;
    - participation in discussions and interactive forms of class organisation;

When searching for information on the Internet, it is recommended to use reliable and verified sources. The work of the applicant involves participation in interactive forms of class organisation (answering questions asked by the teacher or other applicants). Each applicant is expected to be prepared on all issues of the seminar plan, supplement the reports of other applicants, and express their own opinion during thematic discussions. Applicants 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 analyses 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 Classroom).

7.4. Incentive points

Students are encouraged to engage in research work and publish its results, in particular to participate in the All-Ukrainian Student Scientific and Practical Conference "Ukraine: History, Culture, Memory", which is organised annually by the Department of History of Igor Sikorsky KPI. Abstracts presented at the conference on the subject of the academic discipline are awarded additional points. Students, together with the lecturer, decide on the topic of the abstracts, available sources and literature. Also, under the guidance of the lecturer, students familiarise themselves with the requirements for formatting and submit abstracts to the conference.

Additional points are awarded for student participation in the annual Olympiad on "History of Ukraine" (provided that more than 80% of the answers are correct) in the amount of 10 points.

According to clause 2.7 of the Regulations (https://osvita.kpi.ua/node/37), the number of incentive points cannot exceed 10% of the rating scale.

7.5. Repetition and resitting.

Active participation in classes is mandatory and will be required. The student's rating will be largely determined by the results of their work in seminars. Each missed seminar (regardless of the reason for the absence) lowers the student's final rating in the discipline. There is no specific number of missed seminars that will require the student to study the relevant topics independently and communicate with the teacher on this matter. However, a student who has missed seminars may receive a low rating, which will not allow such a student to take the exam.

The applicant will be informed of the deadlines for completing the tasks, which must be adhered to. Students who have missed classes or deadlines for completing tasks must not allow their final grade to be lowered by studying the relevant topics in a timely manner (during the semester) and completing the tasks assigned for the missed classes. Students will have the opportunity to demonstrate their mastery of the missed topics in the exam if they wish to improve their overall rating.

7.6.University policy

Academic integrity

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

Other necessary information regarding academic integrity is defined in the "Regulations on the system for preventing academic plagiarism at Igor Sikorsky Kyiv Polytechnic Institute". For more details, see: https://osvita.kpi.ua/node/47 and the university's website: https://kpi.ua/academic-integrity

Standards of ethical conduct

The standards of ethical conduct for applicants and employees are set out in Section 2 of the Code of Honour of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". For more details, see: https://kpi.ua/code

Artificial intelligence policy

The policy on the use of artificial intelligence and its principles are regulated by the order "Policy on the use of artificial intelligence for academic activities at Igor Sikorsky Kyiv Polytechnic Institute". For more information: https://osvita.kpi.ua/node/1225

8. Types of assessment and the learning outcomes assessment rating system (LOAS)

Types of assessment

Ongoing assessment: work in seminars in the form of problem-based discussions between students on the main issues of the course, with an emphasis on summarising scientific information, formulating one's own position and evaluating what has been presented. Express assessments of mastery of lecture material are conducted in accordance with the lecture schedule. In the context of distance learning, all types of work have specific deadlines.

Calendar control: conducted twice per semester as monitoring of 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.

Criterion		First certification	Second certification
Certification period		7th week	13th week
Conditions for obtaining certification	Current rating	≥ 15 points	≥ 30 points

Semester assessment: pass

Assessment system (current assessment)

The applicant's rating in the discipline consists of points received for:

1) assessment of residual knowledge in lectures in the form of quick tests (tests during distance learning) lasting <5 minutes;
2) work in seminars;
3) completion of a Modular control work consisting of three parts (during distance learning, it is performed in the form of tests).

Assessment system for control measures:

No. No	Assessment	%	Weight score	Number	Total
1.	Work in seminars	75	5	15	**75**
2	Modular control work (three parts)	9	3	3	**9**
3	Checking residual knowledge in lectures	16	2	8	**16**
	Total	**100**			**10**

1. **Work in seminars and report on the topic of the discipline section**

The applicant's work consists of two components: reports in seminars and/or active work in seminars.

The weighting for work in each of the 15 seminars and presentations is 5 points. The maximum number of points for the applicant's work/presentation at the seminar is 5 points * 15 seminars = 75 points.

Criteria for assessing the applicant's work at the seminar:

5 points - the topic is fully covered (at least 90% of the required information). Relevant justifications and a personal view of the problem are provided. Correct and complete answers to questions are provided (at least 90% of the required information). In addition to the report, the applicant took an active part in the seminar.
4 points - the topic is covered sufficiently (at least 75% of the required information). Justifications and/or personal views on the problem are provided with minor inaccuracies. Sufficiently complete answers to questions are provided (at least 75% of the required information). In addition to the report, the applicant took an active part in the seminar.
3 points - the topic is covered incompletely (at least 60% of the required information), insufficiently substantiated. Answers to questions are incomplete (at least 60% of the required information). In addition to the report, the applicant participated in the seminar.

0 points - the seminar report does not meet the requirements for "Sufficient". The topic is not covered, there is no personal view on the problem, and the answers to the questions are incomplete. The applicant did not participate in the discussion of the seminar questions.

2. Modular control work

After completing each of the three thematic modules, students are given a one-time opportunity to write a modular control work, which consists of test and/or descriptive tasks. Each modular control work is assessed at 3 points. The maximum number of points for three modular control works is 9 points.

Assessment criteria for one part of the MCT

3 points	2.5 points	- answers are complete and correct (at least 90% of the required information)
2	2.5	- sufficiently complete answers (at least 75% of the required information)
2 points	1.8 points	**-** incomplete answers (at least 60% of the required information)
0 points	0 points	- no answers or incorrect answers (less than 60% of the required information)

3. Checking residual knowledge in lectures

Residual knowledge is checked during lectures in the form of quick checks (written assignments or tests) lasting less than 5 minutes.

The weighting of one quick check is 2 points. The maximum number of points for the check is 2 points * 8 checks = 16 points.

Assessment criteria for one quick check in text format:

2 points - complete answer (at least 90% of the required information), relevant reasoning and personal view on the problem
1 point - incomplete answer (at least 60% of the required information)
0 points - no answer or incorrect answer (less than 60% of the required information)

Conditions for admission to the semester test: a minimum of 40 points, completion of all parts of the Modular control work/test of residual knowledge with at least 60% of the required information

The candidate receives ***a credit*** without additional tests if the total number of points scored is not less than 60. A candidate who has received more than 60 points during the semester but wishes to improve their result may take part in a credit test or a survey on credit questions. In this case, the final result consists of the points obtained in the test or survey.

Applicants who have fulfilled all the conditions for admission to the exam and have a rating of less than 60 points take a credit test. The final result consists of the points obtained on the credit test.

The test is scored out of 100 points and consists of two questions. *(The maximum number of points for 1 question is 50 points)*

Criteria for assessing the test question

50-45 points - complete answer (at least 90% of the required information)
44-42 points - sufficiently complete answer (at least 85% of the required information) or complete answer with minor inaccuracies
41-38 points - the answer to the question is generally complete (at least 75% of the required information)
37-33 points - incomplete answer (at least 65% of the required information)
32-30 points - incomplete answer (at least 60% of the required information), significant errors
0 points - incomplete answer (less than 60% of the required information) or no answer

In order to receive the highest rating, the applicant must: actively participate in seminars, deliver well-prepared and reasoned oral reports on seminar topics, actively supplement the answers of other applicants, clearly and logically express their own position on discussion topics; complete the Modular control work and express controls in a timely manner. The applicant is given a one-time opportunity to complete the Modular control work and express controls.

The following will lead to a decrease in the applicant's rating: failure to complete Modular control work and express controls; inadequate preparation for seminars; inaccuracies, incompleteness, errors in answers or reliance on unreliable historical sources.

The applicant may appeal the teacher's assessment by submitting a complaint to the teacher no later than the day after the applicant has been informed of the assessment. The complaint will be considered in accordance with the procedures established by the university https://osvita.kpi.ua/node/182.

The applicant's rating consists of points received by the applicant based on the results of current control measures, incentive and penalty points. The teacher converts them into a rating and translates them into grades on the university scale (Table 1).

Table 1. Correspondence of rating points to grades on the university scale:

Number of points	*Grade*
100–95	Excellent
94	Very good
84–75	Good
74–65	Satisfactory
64–60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

Possible marks in the semester control report:

Not admitted	Failure to meet the conditions for admission to semester control
Removed	Violation of the principles of academic integrity or moral and ethical standards of conduct
Did not appear	The applicant was admitted but did not appear for the exam

9. Additional information on the discipline (educational component)

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

The recommended list of topics for the Modular control work is provided in section 5.2 of the syllabus.

The list of topics for express tests or creative assignments during distance learning in lectures is provided in section 5.1 of the syllabus.

Recognition of learning outcomes at other higher education institutions, as well as in non-formal/informal education.

At the University, the recognition of learning outcomes at other higher education institutions, including in non-formal/informal education, is approved in:

- Regulations on the recognition of foreign educational documents (https://osvita.kpi.ua/node/123);
- Regulations on the recognition of learning outcomes acquired in non-formal/informal education at Igor Sikorsky KPI (https://osvita.kpi.ua/node/179);
- Regulations on Academic Mobility (https://osvita.kpi.ua/node/124);
- Procedure for drawing up individual study plans for students participating in academic mobility programmes (https://osvita.kpi.ua/node/186).

If the applicant has documents confirming their participation in scientific conferences (city, inter-city, All-Ukrainian, etc.), academic mobility (including individual) on the topic of a seminar or section of an academic discipline, they may be taken into account by the teacher in semester and current assessments in accordance with the rating system for evaluating learning outcomes. Additional validation of informal

learning outcomes is not provided for (in accordance with clause 2.2. of the Regulations on the recognition of learning outcomes acquired in informal/non-formal education at Igor Sikorsky Kyiv Polytechnic Institute).

Extracurricular classes

Students may participate in:

- scientific research work and the publication of its results, in particular, at the All-Ukrainian Student Scientific and Practical Conference "Ukraine: History, Culture, Memory", which is held annually by the Department of History and others;
- activities of the student scientific club "History Fans Club";

an Olympiad in historical disciplines, including "History of Ukraine," held by the Department of History.

Distance learning

Synchronous and asynchronous distance learning is possible using the video conferencing platform (Google Meet) and the "Sikorsky" distance learning educational platform (Google Classroom).

The distance learning process is carried out in accordance with the approved schedule of classes. Classes are conducted using modern resources for online meetings (organisation of video conferences).

Inclusive education

Permitted in accordance with the "Regulations on the Organisation of Inclusive Education at Igor Sikorsky KPI" (2020). Details: https://osvita.kpi.ua/ppoin

Working programme of the academic discipline (syllabus):

Compiled

Associate Professor of the Department of History, Candidate of Historical Sciences, Associate Professor Serhii CHOLII

Position, academic degree, academic title, full name

Approved by the Department of History (Minutes No. 14 of 18 June 2025)

Approved by the Methodological Commission of the Faculty (Minutes No. 4 of 24 June 2025)

Appendix A
List of questions for semester assessment (test)

Sample test paper

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

Level of higher education first (bachelor's)

Speciality **C5 Sociology**
(code and name of the field of study)

Educational programme *Social Data Analytics*
(code and name of specialisation)

Academic discipline ***Scientific and technological revolutions and modernisation of Europe***
(name)

TEST TICKET No. ____

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

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

Minutes No. _____ date d " " 202 _____

Head of the Department of History _____
(signature) (Surname and initials)

QUESTIONS for the preparation of exam papers

Question I from the set of questions

1. Define the role of scientific and technological revolutions in the development of the European region.
2. Provide a definition and reasoned assessment of the problem of humanising scientific and technological knowledge.
3. Compare the main versions of the periodisation of history.
4. Describe the source base of history, taking into account the characteristics of different types of sources.
5. Analyse the level of development of human knowledge and technology in the Palaeolithic and Mesolithic periods.
6. Characterise the Neolithic revolution in its main centres, linking the level of development of knowledge and technology with natural conditions.
7. Describe and explain the peculiarities of the development of technology in ancient Greece.
8. Give a reasoned assessment of the transition from a mythological to a scientific perception of the world in ancient Greece, using the example of its influence on natural and technical knowledge.
9. Using the comparative-historical method, identify new features in the development of scientific and technical knowledge in the Hellenistic period.
10. Identify the key features of the development of science and technology during the Roman Empire. Justify your answer.
11. Compare approaches to the development of scientific knowledge in the Christian and Muslim worlds of the Middle Ages.

12. 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.
13. Explain how the spread of humanism and the Reformation influenced the development of science in Europe during the Renaissance.
14. Define the essence of the Great Geographical Discoveries and their consequences for scientific and technological development.
15. Give a reasoned opinion on whether it is appropriate to use the terms "gunpowder revolution" and "agricultural revolution" in relation to Renaissance Europe.
16. Identify the preconditions and explain the essence of the scientific revolution of the 17th century.
17. Explain how the spread of Enlightenment ideology and scientific and technological progress are related.
18. Describe the main consequences of the scientific revolution of the 17th century and the essence of the mechanistic worldview.
19. Describe Alvin Toffler's "three waves" theory. How can it be applied to describe the development of Europe?
20. What were the consequences of European modernisation in the 19th century?

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 classical 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-classical and classical science.
7. Provide a reasoned explanation of the impact of the First World War 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. Give a reasoned assessment of the overall state of science and technology during the Second World War, depending on the extent of countries' participation in hostilities.
11. Describe the structure, periodisation 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 programmes.
14. Compare the leading concepts for defining the 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 in 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.

Appendix B
List of indicative questions for the Modular control work

I. MODULE 1 (Section 1: The Agrarian Era, from Prehistory to the 17th Century) — 14 questions

Topic 1.1. Theoretical and methodological foundations of the course

1. Explain the subject and method of the history of science and technology. How does it differ from historical science in general?
2. What methodological approaches are used to study the development of technology and scientific knowledge?
3. Assess the interaction between the natural, physical, mathematical and technical sciences at different stages of history.
4. Explain the significance of the history of science and technology for modern society and for social data analytics.

Topic 1.2. Prehistoric knowledge and technology of ancient civilisations

5. Analyse the impact of the Neolithic Revolution on the technological development of humanity.
6. Explain the role of the emergence of metallurgy in the formation of the first specialised crafts.
7. Describe the main technical achievements of ancient civilisations (Egypt, Mesopotamia, China, Greece).
8. Compare the level of technological development of ancient states and civilisations of the Ancient East.
9. Describe the first branches of rational knowledge in the ancient world.

Topic 1.3. Medieval technology and the scientific revolution of the 17th century.

10. Analyse the main directions of technical development in medieval Europe (agriculture, crafts, construction).
11. Describe the scientific and technical achievements of medieval China and Central Asian countries.
12. What factors led to the emergence of manufactories and the first machines in Europe?
13. Explain the role of the 16th–17th centuries in the formation of a new scientific picture of the world.
14. Analyse the significance of the scientific revolution of the 17th century for the development of engineering thought and technical education.

II. MODULE 2 (Section 2: The Industrial Age) — 16 questions

Topic 2.1. Technology and scientific knowledge in the 18th–70s of the 19th century

15. Explain the causes and preconditions of the first industrial revolution.
16. Describe the main technical innovations in the textile and metallurgical industries in the 18th century.
17. Analyse the emergence of the steam engine and its impact on the economy and society.
18. Assess the development of transport and communications in the 18th and first half of the 19th centuries.
19. How did the status of scientific knowledge change during the formation of classical natural science?

Topic 2.2. New discoveries at the turn of the 19th and 20th centuries.

20. What factors led to the second stage of the Industrial Revolution?
21. Analyse the development of mathematics and astronomy in the 19th century.
22. Describe the fundamental discoveries in physics at the end of the 19th and beginning of the 20th centuries (electromagnetism, X-rays, radioactivity).
23. Explain the significance of new discoveries in chemistry, geology, and biology for technological development.
24. Analyse the interaction between science and industry in the second half of the 19th century.

Topic 2.3. The end of the Modern era

25. Explain the role of electrical engineering in the formation of a new industrial civilisation.
26. Describe the new technologies in metallurgy and the chemical industry in the late 19th and early 20th centuries.

27. Analyse the significance of the emergence of the automobile, aeroplane and new modes of transport for the modernisation processes in Europe.
28. Explain how technological progress changed military technology during the First World War.
29. Assess the results of European modernisation by the beginning of the 20th century.

III. MODULE 3 (Section 3: The Information Age and the Scientific and Technological Revolution) — 10 questions

Topic 3.1. Science and technology in the 1920s–1940s

30. Describe the development of the electric power industry in the interwar period.
31. Analyse the technical achievements in mechanical engineering in the 1920s–1930s.
32. Explain the role of aviation and rocket science in the development of military technology before World War II.
33. Describe the beginning of the atomic age and its impact on technological progress.
34. Assess the emergence of electronics as the foundation of the future scientific and technological revolution.

Topic 3.2. The scientific and technological revolution and the formation of the information society

35. Explain the importance of electrical engineering and electronics in the formation of the information society.
36. Describe the main achievements of the chemical, metallurgical and machine-building industries in the second half of the 20th century.
37. Analyse the development of transport and cosmonautics in the context of the scientific and technological revolution.
38. Explain the evolution of communication from telephony to computer networks.
39. Assess the role of computer systems in the formation of a new model of social development in Europe.
40. Explain why the scientific and technological revolution determines the transition from an industrial to an information society.