Syllabus
Spring semester 2021-2022 academic year
for the educational programs 7M05301 – Chemistry, 7M07105 - Chemical Technology of Inorganic Substances, 7M07106 - Chemical Technology of Organic Substances, 7M07103 – Chemical Engineering, 7M07122 – Nanomaterials and Nanotechnologies in Chemistry, 7M07104 – Chemical Technology of Explosives and Pyrotechnics, 7M07201 – Oil and Gas Business, 7M07101 – Petrochemistry

Code of the course	Title of the course	Assign-ments	Number of hours			Credits	Tutorials
			Lec	Sem	Lab		
OPNI 5302	Organization and planning of scientific research	98	15	30	0	5	7

Academic information about the course					
Type of education	Type/character of course	Type of lectures	Type of seminars	Number of assignments	Form of final control
Mixed	Mixed	Problem, analytical lecture	Mixed	3	Project

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Academic presentation of the course

Aim of discipline	Expected learning outcomes (LO)	Achievement indicators for LO (AI)
Aim of the course is to develop skills of using modern IT tools for scientific research and modeling in chemistry and chemical engineering.	As a result of the course, a student will be able to:	
	LO 1 Obtain new knowledge and solve problems using scientific method	AI 1.1 Formulate research questions AI 1.2 Formulate hypotheses AI 1.3 Test hypotheses AI 1.4 Apply scientific method for solution of real problems AI 1.5 Apply scientific method for obtaining knowledge AI 1.6 Understand advantages of scientific method over other methods
	LO 2 Conduct literature research	AI 2.1 Understand the importance of literature research AI 2.2 Set up a goal and formulate questions for literature research AI 2.3 Find reliable sources of literature using databases and search tools AI 2.4 Use reference management tools AI 2.5 Analyze scientific articles

		AI 2.6 Find knowledge gaps AI 2.7 Write a literature review AI 2.8 Make conclusions based on literature research
	LO 3 Plan research experiments	AI 3.1 Justify an importance of a research experiment AI 3.2 Choose proper independent, dependent and controlled variables, and their values AI 3.3 Develop a detailed procedure of an experiment AI 3.4 Develop a detailed procedure of data processing AI 3.5 Formulate expected results of an experiment AI 3.6 Plan a series of research experiments
	LO 4 Prepare and submit research articles and dissertations	AI 4.1 Prepare an outline of a research article and dissertation AI 4.2 Build and describe high-quality figures and tables AI 4.3 Write different sections of a research article AI 4.4 Choose a research journal for submission of a manuscript AI 4.5 Prepare a manuscript for submission to a chosen journal AI 4.6 Respond to reviewers' comments AI 4.7 Defend a dissertation
	LO 5 Prepare research projects	AI 5.1 Find a topic and goal of a research project AI 5.2 Develop a detailed plan of a project using a Gantt chart AI 5.3 Justify an importance of the project AI 5.4 Justify resources required for implementation of a project AI 5.5 Find a potential funding agency, competition or sponsor AI 5.6 Prepare and implement projects on commercialization and implementation of scientific results
	LO 6 Present research projects and results as oral and poster presentation	AI 6.1 Prepare a speech for oral and poster presentations AI 6.2 Prepare high-quality and interesting slides and posters AI 6.3 Make oral and poster presentations AI 6.4 Answer questions and defend own conclusions AI 6.5 Present a research project AI 6.6 Communicate with other researchers, journalists, officials and general public

	LO 7 Establish a successful research career	AI 7.1 Understand requirements to different research degrees, positions and career paths AI 7.2 Apply scientometric indicators for evaluating the level and impact of a researcher, organization and country AI 7.3 Understand differences between research careers in academia and industry AI 7.4 Understand rights, obligations and support of researchers in Kazakhstan AI 7.5 Understand problems and prospects in the development of scientific research in Kazakhstan AI 7.6 Understand rules of research ethics
Prerequisites and Postrequisites	**No**	
Literature and resources	**Literature**: 1. Hofmann A. Scientific writing and communication: Papers, Proposals, and Presentations. - Oxford University Press, 2009. – 704 p. ISBN 01953-90059 2. Carter M. Designing Science Presentations: A Visual Guide to Figures, Papers, Slides, Posters, and More. - Academic Press, 2013. – 384 p. ISBN 01238-59697 3. Carey S.S. A Beginner's Guide to Scientific Method. – Wadsworth Publishing, 2003. – 160 p. ISBN 11113-05552. 4. Schimel J. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded. - Oxford University Press, USA, 2011. – 240 p. ISBN 01997-60241. 5. Gauch H.G. Scientific Method in Practice. - Cambridge University Press, 2002. - 456 p. ISBN 05210-17084. 6. Cohen C.M., Cohen S.L. Lab Dynamics: Management and Leadership Skills for Scientists, Second Edition. - Cold Spring Harbor Lab, 2012. – 280 p. 7. Kumar R. Research Methodology: A Step-by-Step Guide for Beginners. - Sage Publications Ltd., 2010. – 440 p.	
Academic policy of the course in the context of university moral and ethical values	1. Every student should be prepared to each class according to the schedule provided below. Preparation should be finished prior to the class. 2. Lectures and seminars will be devoted to the discussion of questions and problems, as well as to the development of high-level thinking skills (analysis, synthesis, critical evaluation). Active participation of students in discussions and exercises during classes will be considered during grading. Constructive questions, dialogues and feedback on the course are encouraged during classes. 3. Homework will be provided during lectures and seminars or sent via e-mail. Solutions of tasks should be prepared as a report in written or electronic form. Solution should be clear, accurate and reasonable. 4. The course will include three assignments. 5. Terms for submission of assignments and projects can be prolonged in the case of serious reasons (health problems, emergencies, accidents, etc.) in accordance to the Academic Policy of the University. Course Policy: – Raise your hand if you wish to say something during a class. – Please be tolerant, respect other people's views. – Express your objections in correct form. – All assignments must be submitted before deadlines. In the case of delays, assignments will not be considered by the lecturer. – Plagiarism and other forms of unfair work are not acceptable. Prompting and copying off during various tests and examinations are forbidden.	

Assessment policy	**Criterion assessment:** the level of students' competence will be determined as the result of control works, midterm and final examinations. **Summative assessment:** during seminars, the level of student's knowledge and understanding of topics as well as practical skills will be determined. Formula for calculating the final grade: Seminars – 19%; Control works – 26%; Individual assignments – 15%; Final exam – 40%.

Schedule for the implementation of the content of the learning course

Week / module	Topic	LO	AI	Number of hours	Max points	Knowledge Assessment Form	Lesson form /platform
Module							
1	**Lecture 1** Introduction to a modern science and scientific method	LO 1	AI 1.1 AI 1.2 AI 1.3 AI 1.4 AI 1.5 AI 1.6	1	-	-	Online video conference
1	**Seminar 1** Application of scientific method for solution of problems and obtaining new knowledge	LO 1	AI 1.1 AI 1.2 AI 1.3 AI 1.4 AI 1.5	2	6	Oral talk Answering questions	Online video conference
2	**Lecture 2** Scientific method: observation, explanation and formulating working hypothesis	LO 1	AI 1.1 AI 1.2	1	-	-	Online video lecture
2	**Seminar 2** Looking for problems and formulating hypothesis. Creativity tools	LO 1	AI 1.1 AI 1.2	2	6	Oral talk Answering questions	Online video conference
2	**Tutorial 1** Discussing questions for the assignment 1	LO 2	AI 2.2 AI 2.3 AI 2.4	1	-	-	Online video conference
3	**Lecture 3** Literature research: importance, goals, sources, methods and rules.	LO 2	AI 2.1 AI 2.2 AI 2.3 AI 2.4 AI 2.5 AI 2.6 AI 2.7 AI 2.8	1	-	-	Online video conference
3	**Seminar 3** International databases of abstracts and search tools: Web of Science, Scopus, SciFinder	LO 2	AI 2.2 AI 2.3	1	3	Oral talk Answering questions	Online video conference
3	**Seminar 4** Tools for managing references and organizing literature. Practical aspects of using Mendeley and EndNote	LO 2	AI 2.4	1	3	Oral talk Answering questions	Online video conference
3	**Tutorial 2** Discussing questions for the assignment 1	LO 2	AI 2.2 AI 2.3 AI 2.4	1	-	-	Online video conference
4	**Lecture 4** Analyzing scientific articles and finding knowledge gaps	LO 2	AI 2.5 AI 2.6	1	-	-	Online video conference
4	**Seminar 5** Practice on analyzing scientific articles and finding knowledge gaps	LO 2	AI 2.5 AI 2.6	1	3	Oral talk Answering questions	Online video conference
4	**Seminar 6** Writing a literature review	LO 2	AI 2.7 AI 2.8	1	3	Oral talk Answering questions	Online video conference
4	**Tutorial 3** Submission of the assignment 1	LO 2	AI 2.2 AI 2.3	1	30	Evaluation of the table	Online video conference

	Conduct literature research for your M.S. dissertation. Prepare the table with at least 20 questions, answers (if available), argument(s), problems and references.		AI 2.4 AI 2.5 AI 2.6				
5	**Lecture 5** Research experiments. Importance, variables, procedure, data processing	LO 3	AI 3.1 AI 3.2 AI 3.3 AI 3.4 AI 3.5	1	-	-	Online video conference
5	**Seminar 7** Practice on planning research experiments	LO 3	AI 3.2 AI 3.3 AI 3.4	1	6	Oral talk Answering questions	Online video conference
5	**Assessment 1**	LO 1 LO 2 LO 3	AI 1.1-6 AI 2.1-8 AI 3.1-6	1	43	Written test	Online video conference
5	**Intermediate control 1**				100		
6	**Lecture 6** Writing a research manuscript: what to publish and where, preparation of the outline and first draft, internal review	LO 4	AI 4.1 AI 4.4	1	-	-	Online video conference
6	**Seminar 8** Practicing and improving writing skills	LO 4	AI 4.2 AI 4.3	2	6	Oral talk Answering questions	Online video conference
7	**Lecture 7** Submitting a research manuscript, review process and revision	LO 4	AI 4.4 AI 4.5 AI 4.6	1	-	-	Online video conference
7	**Seminar 9** Writing and defending a dissertation	LO 4	AI 4.7	1	3	Oral talk Answering questions	Online video conference
7	**Seminar 10** Problems of students in scientific writing. Development of writing skills	LO 4	AI 4.1 AI 4.2 AI 4.3 AI 4.5	1	3	Oral talk Answering questions	Online video conference
8	**Lecture 8** Presentation of the research and networking with other scientists	LO 6	AI 6.1 AI 6.2 AI 6.3 AI 6.4 AI 6.6	1	-	-	Online video conference
8	**Seminar 11** Every student should prepare and give 2-minute (max) oral presentation about his or her research without slides	LO 6	AI 6.1 AI 6.3 AI 6.4	2	6	Evaluation of the quality of the presentation	Online video conference
8	**Tutorial 4** Discussing questions for the assignment 2	LO 2	AI 2.5 AI 2.6 AI 2.7 AI 2.8	1	-	-	Online video conference
9	**Lecture 9** Presentation of a research project	LO 6	AI 6.1 AI 6.2 AI 6.3 AI 6.4 AI 6.5	1	-	-	Online video conference
9	**Seminar 12** Every student should prepare and give 4-minute (max) oral presentation about his or her research with slides	LO 6	AI 6.1 AI 6.3 AI 6.4	2	6	Evaluation of the quality of the presentation	Online video conference

9	**Tutorial 5** Submission of the assignment 2 *Critically analyze collected sources of scientific information. Prepare the first draft of a literature review on the topic of dissertation*	LO 2	AI 2.5 AI 2.6 AI 2.7 AI 2.8	1	30	Evaluation of the quality of literature review	Online video conference
10	**Lecture 10** Preparation of a research project proposal	LO 5	AI 5.1 AI 5.2 AI 5.3 AI 5.4	1	-	-	Online video conference
10	**Seminar 13** Every student should prepare and give 4-minute (max) oral presentation about his or her research with slides" (continued)	LO 6	AI 6.1 AI 6.3 AI 6.4	1	3	Evaluation of the quality of the presentation	Online video conference
10	**Assessment 2**	LO 4 LO 5 LO 6	AI 4.1-7 AI 5.1-7 AI 6.1-6	1	43	Written test	Online video conference
10	**Intermediate (midterm) control 2**				100		
11	**Lecture 11** Funding sources for scientists (including students) in Kazakhstan and around the world	LO 5	AI 5.5	1	-	-	Online video conference
11	**Seminar 14** Poster session: every student should prepare A1 size poster on his or her research and present it to other students	LO 3	AI 3.1 AI 3.2 AI 3.3	2	6	Evaluation of the quality of the presentation	Online video conference
12	**Lecture 12** Commercialization and implementation of scientific results	LO 1	AI 1.2 AI 1.3	1	-	-	Online video conference
12	**Seminar 15** Practice on preparation of a research project proposal	LO 5	AI 5.2 AI 5.3 AI 5.4	1	3	Oral talk Answering questions	Online video conference
12	**Seminar 16** Preparation and implementation of projects on commercialization and implementation of scientific results	LO 5	AI 5.6	1	3	Oral talk Answering questions	Online video conference
12	**Tutorial 6** Discussing questions for the assignment 3	LO 2	AI 2.5 AI 2.6 AI 2.7 AI 2.8	1	-	-	Online video conference
13	**Lecture 13** Academic degrees: differences and possibilities. Indicators of the level and impact of a researcher, organization and country	LO 7	AI 7.1 AI 7.2	1	-	-	Online video conference
13	**Seminar 17** Role and place of researchers in the modern society. Researchers in academia and industry	LO 7	AI 7.3	2	6	Oral talk Answering questions	Online video conference
14	**Lecture 14** Rights, obligations and support of researchers in Kazakhstan	LO 7	AI 7.4	1	-	-	Online video conference
14	**Seminar 18** Development of professional, creativity and other new skills of researchers	LO 7	AI 7.1	1	3	Oral talk Answering questions	Online video conference
14	**Seminar 19** Problems and prospects in the development of scientific research in Kazakhstan	LO 7	7.5	1	3	Oral talk Answering questions	Online video conference

14	**Tutorial 7** **Submission of the assignment 3** Submit the final version of a literature review on the topic of dissertation	LO 2	AI 2.5 AI 2.6 AI 2.7 AI 2.8	1	30	Evaluation of the literature review	Online video conference
15	**Lecture 15** Research ethics	LO 7	AI 7.6	1	-	-	Online video conference
15	**Seminar 20** Discussion of the results of the course	**LO 1-7**	All AIs	1	3	Oral talk Answering questions	Online video conference
15	**Assessment 3**	LO 5 LO 7	AI 5.1-6 AI 7.1-6	1	43	Written test	Online video conference
15	Intermediate control 3				100		
	Final control	LO 1-7	All AIs		100	Project	
	TOTAL				100		

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