

**SYLLABUS**  
 Fall semester 2024-2025 academic year  
 Educational program "8D06104- Mathematical and computer modeling"

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
ChMNTTT-7302 Numerical simulation of unsteady three-dimensional turbulence flows	7	1,7	1,7	1,6	5	7
<b>ACADEMIC INFORMATION ABOUT THE COURSE</b>						
Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control		
Offline	theoretical	analitical	Task solution	writing		
<b>Lecturer - (s)</b>	Abdibekov Ualikhan Seidildaevich				Scheduled	
<b>e-mail :</b>	uali@kaznu.kz					
<b>Phone :</b>	2211589					
<b>ACADEMIC COURSE PRESENTATION</b>						
Purpose of the course	Expected Learning Outcomes (LO) As a result of studying the discipline the undergraduate will be able to:			Indicators of LO achievement (ID)		
	LO 1. Description of turbulent processes by mathematical equations			ID.1 numerical method construction		
	LO 2. Construction of a mathematical model of the process			ID. 2 constructing an algorithm		
	LO 3. Selection of closure methods			ID. 3constructing an algorithm		
	LO 4. Construction of a mathematical model of turbulent flow for large Reynolds numbers			ID. 4compiling program code		
	As a result of studying the discipline, the doctoral candidate will be able to independently understand scientific articles and independently build models for turbulent flow					
<b>Prerequisites</b>	<b>Mathematical and computer modeling of physical proceses, continuum mechanics, mechanic of fluid, computational fluid dynamic</b>					
<b>Postrequisites</b>						
<b>Learning Resources</b>	literature: 1. Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 1, - 676 с. 2. Монин А.С., Яглом А.М. Статистическая гидромеханика. - М.:Наука,1965. - Ч. 2 - 686 с. 3. Хинце И.О. Турбулентность. М.:Физматгиз, 1963. - 680 с. 4. Турбулентность. Принципы и применения. - М.: Мир, 1980. - 535 с. 5. Методы расчета турбулентных течений. - М.: Мир, 1984. -464 с. 6. Davidson P.A. Turbulense. An Introduction for Scientists and Engineers, OXFORD University Press 2004. – 678 p. 7. P.Sagaut,S.Deck,M.Terracol_Multiscale_and_Multiresolution_Approaches_in_Turbulence_Imperia I College Press 2006. – 356 p. 8. Жумагулов Б.Т., Абдибеков У.С., Исахов А.А. Основы математического и компьютерного моделирования естественно-физических процессов. Алматы, Қазақ университеті, 2014, -206 стр. Internet-resources: Additional educational material, lecture and practical classes, CDS assignments are uploaded to the teaching materials section of the univer.kaznu.kz website.					

<b>Academic course policy</b>	<p>Academic Behavior Rules: All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule. ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC.</p> <p>Academic values: - Practical trainings/laboratories, IWS should be independent, creative. - Plagiarism, forgery, cheating at all stages of control are unacceptable. - Students with disabilities can receive counseling at e-mail uali@kaznu.kz</p> <p><b>Criteria-based evaluation:</b> assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams).</p> <p><b>Summative evaluation:</b> assessment of work activity in an audience (at a webinar); assessment of the completed task.</p>
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**INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT**

Score-rating letter system of assessment of accounting for educational achievements				Assessment Methods	
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system		
A	4.0 _	95-100	Great	<p><b>Criteria-based assessment</b> is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.</p> <p><b>Formative assessment</b> is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.</p> <p><b>Summative assessment</b> - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.</p>	
A-	3.67	90-94			
B+	3.33	85-89	Fine	<p><b>Formative and summative assessment</b> The teacher introduces his own types of assessment or uses the proposed option</p> <p><b>Points % content</b> The teacher enters his score into points in accordance with the calendar (schedule). <u>The exam does not change and the final score in the course.</u></p>	
B	3.0	80-84			
B-	2.67	75-79			
C+	2.33	70-74			
C	2.0	65-69	Satisfactorily	Activity at lectures	
C-	1.67	60-64		5	
D+	1.33	55-59	Unsatisfactory	Work in practical classes	
D	1.0	50-54		20	
				Independent work	
			25		
			Design and creative activity		
			10		
			Final control (exam)		
			40		
			TOTAL		
			100		

**Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.**

A week	Topic name	Number of hours	Max. ball
<b>MODULE 1. MODELING THE PROBLEMS OF THE ATMOSPHERE AND OCEAN.</b>			
1	Lecture 1. The mathematical modeling physical processes. Introduction.	1	
	Practical class 1. Related exercises	2	6
2	Lecture 2. Mathematical modeling of atmospheric processes	1	
	Practical class 2. Related exercises	2	6
3	Lecture 3. Mathematical modeling of pollution of oceans and seas.	1	
	Practical class 3. Related exercises	2	6
	Independent work of student with teacher: IWST 1.		24
4	Lecture 4. Mathematical modeling of short-term weather forecast.	1	
	Practical class 4. Related exercises	2	6
5	Lecture 5. Mathematical modeling of tropical cyclones (tornadoes).	1	
	Practical class 5. Related exercises	2	6
	Independent work of student with teacher: IWST 2.		30
<b>MODULE 2. MODELING COMPLEX PHYSICAL PROCESSES</b>			
6	Lecture 6. Mathematical modeling of near space.	1	
	Practical class 6. Related exercises	2	8
7	Lecture 7. Mathematical modeling of the hydrodynamics of aluminum electrolyzers	1	
	Practical class 7. Related exercises	2	8
<b>Midterm control 1</b>			<b>100</b>
8	Lecture 8. Modeling the dynamics of ionospheric plasma	1	
	Practical class 8. Related exercises.	2	6
	Independent work of student with teacher: IWST 3.		10
9	Lecture 9. Mathematical modeling of internal flows.	1	
	Practical class 9. Related exercises	2	6
10	Lecture 10. Mathematical modeling of chemical processes in a confined space	1	
	Practical class 10. Related exercises	2	6
	Independent work of student with teacher: IWST 4.		10
<b>MODULE 3. CFD NONSTATIONARE PROCESSES</b>			
11	Lecture 11. Fractional-Step Methods for three-dimensional parabolic equation.	1	
	Practical class 11. Related exercises	2	6
12	Lecture 12. Fourier method for the three-dimensional pressure equation.	1	
	Practical class 12. Related exercises	2	6
	Independent work of student with teacher: IWST 5.		10
13	Lecture 13. RANS for nonstationare physical processes	1	
	Practical class 13. Related exercises	2	6
14	Lecture 14. A Reynolds stress model for velocity and scalar fields.	1	
	Practical class 14. Related exercises	2	6
	Independent work of student with teacher: IWST 6.		10
15	Lecture 15. LES for physical processes.	1	
	Practical class 15. Related exercises	2	8
	Independent work of student with teacher: IWST 7.		10
<b>Midterm control 2</b>			<b>100</b>
<b>Final control (exam)</b>			<b>100</b>
<b>TOTAL for course</b>			<b>100</b>

Dean \_\_\_\_\_ **Doszhan N.S.**

Chair of the Academic Committee  
on the Quality of Teaching and Learning \_\_\_\_\_ **Akhmetova B.I.**

Acting Head of Department \_\_\_\_\_ **Mausumbekova S.D.**

Lecturer \_\_\_\_\_ **Abdibekov U.S.**



**RUBRICATOR OF THE SUMMATIVE ASSESSMENT**  
**CRITERIA EVALUATION OF LEARNING OUTCOMES**

Issued at the request of the teacher for each planned summative assessment (IWST)

**TEMPLATE**

**Task name** (points, % content from 100% MC, copy from the calendar (graphics) implementation of the content of the training course, methods of teaching and learning

Criterion	"Excellent" Max. weight in %	"Good" Max. weight in %	"Satisfactory" Max. weight in %	"Unsatisfactory" Max. weight in %
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**Example 1. Written assignment "My professional history" (25% of 100% MC)**

Criterion	"Excellent" 20-25%	"Good" 15-20%	"Satisfactory" 10-15%	"Unsatisfactory" 0-10%
<b>Understanding Theories and concepts of professional identity and professionalism of a teacher</b>	Deep understanding of theories, concepts of professional identity and teacher professionalism. Relevant and relevant links (citations) to key sources are provided.	Understanding theories, concepts of professional identity and teacher professionalism. Links (citations) to key sources are provided.	Limited understanding of theories, concepts of professional identity and teacher professionalism. Limited references (citations) to key sources are provided.	Superficial understanding / lack of understanding of theories, concepts of professional identity and professionalism of the teacher. Relevant references (citations) to key sources are not provided.
<b>Awareness of key issues of professional identity and professionalism of teachers in Kazakhstan</b>	Links well the key concepts of professional identity and teacher professionalism with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	Links the concepts of professional identity and teacher professionalism with the context of Kazakhstan. Supports arguments with evidence from empirical research.	Limited connection of the concepts of professional identity and professionalism of teachers with the context of Kazakhstan. Limited use of evidence from empirical research.	There is little or no connection between the concepts of a teacher's professional identity and the context of Kazakhstan. Little or no use of empirical research.
<b>Policy proposal or practical recommendations/suggestions</b>	Offers sound policy and/or practical recommendations, proposals for improving the professional identity and professionalism of teachers in Kazakhstan.	Offers some policy and/or practical recommendations, proposals for enhancing the professional identity and professionalism of teachers in Kazakhstan.	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.

	The writing demonstrates clarity, conciseness and correctness. Strictly follows the APA style.	The letter demonstrates clarity, conciseness and correctness. Basically follows the APA style.	The letter has some key errors and clarity needs to be improved. There are mistakes in following the APA style.	The writing is unclear, it is difficult to follow the content. Lots of mistakes in following the APA style.
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Example 2. Group presentation "Teaching profession in Kazakhstan" (30% of 100% RK)

Criterion	"Excellent" 25-30%	"Good" 20-20%	"Satisfactory" 15-20%	"Unsatisfactory" 0 – 15%
Understanding theories and concepts of the professional identity of the teacher and the teaching profession	Deep understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Understanding theories, concepts of the professional identity of the teacher and the teaching profession.	Limited understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Superficial understanding / lack of understanding of theories, concepts of the professional identity of the teacher and the teaching profession.
Awareness of key issues of the professional identity of the teacher and the teaching profession in Kazakhstan	Competent correlation of the key concepts of the professional identity of the teacher and the teaching profession with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	There is a connection between the concepts of professional identity of a teacher and the teaching profession with the context of Kazakhstan. The arguments are backed by evidence from empirical research.	Limited correlation of the professional identity of the teacher and the concepts of the teaching profession with the context of Kazakhstan. Limited use of evidence from empirical research	Insignificant connection / lack of connection between the concepts of the teacher's professional identity and the context of Kazakhstan. Little or no empirical research is used.
Pilot Study	Excellent use of the results of pilot studies (interviews or surveys) in the presentation	Good use of the results of pilot studies (interviews or surveys) in the presentation.	Satisfactory use of the results of pilot studies (interviews or surveys) in the presentation.	Poor use of the results of pilot studies (interviews or surveys) in the presentation.
Suggestion of policy or practical recommendations/suggestions	Offers very good policy and/or practical advice or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Offers some policy and/or practical recommendations or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.
Presentation, teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality visuals, slides or other materials, good teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low engagement, low quality content, poor teamwork.